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Engineering and Mining Journal

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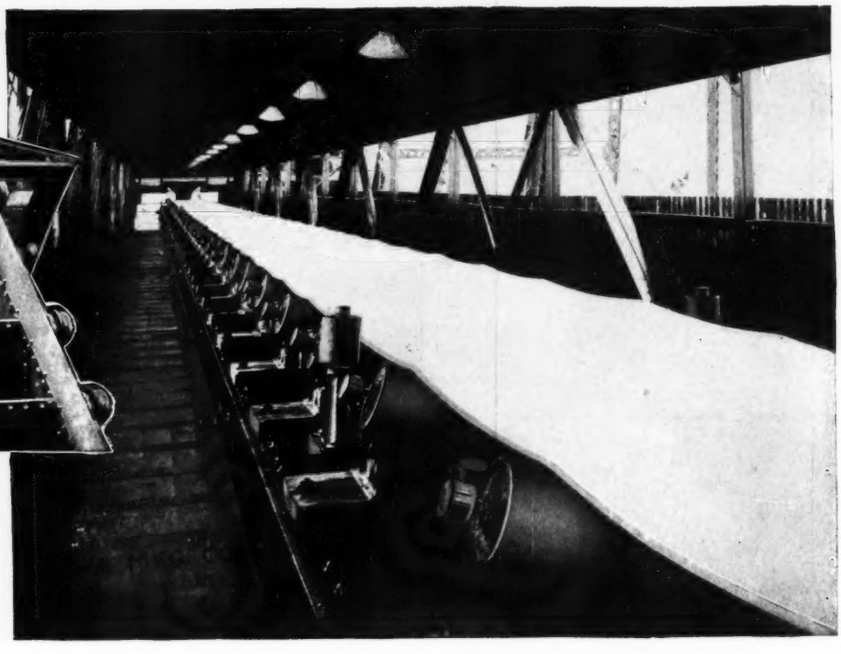

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Engineering and Mining Journal

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British America Nickel Corporation's New Works in Ontario

By E. P. MATHEWSON

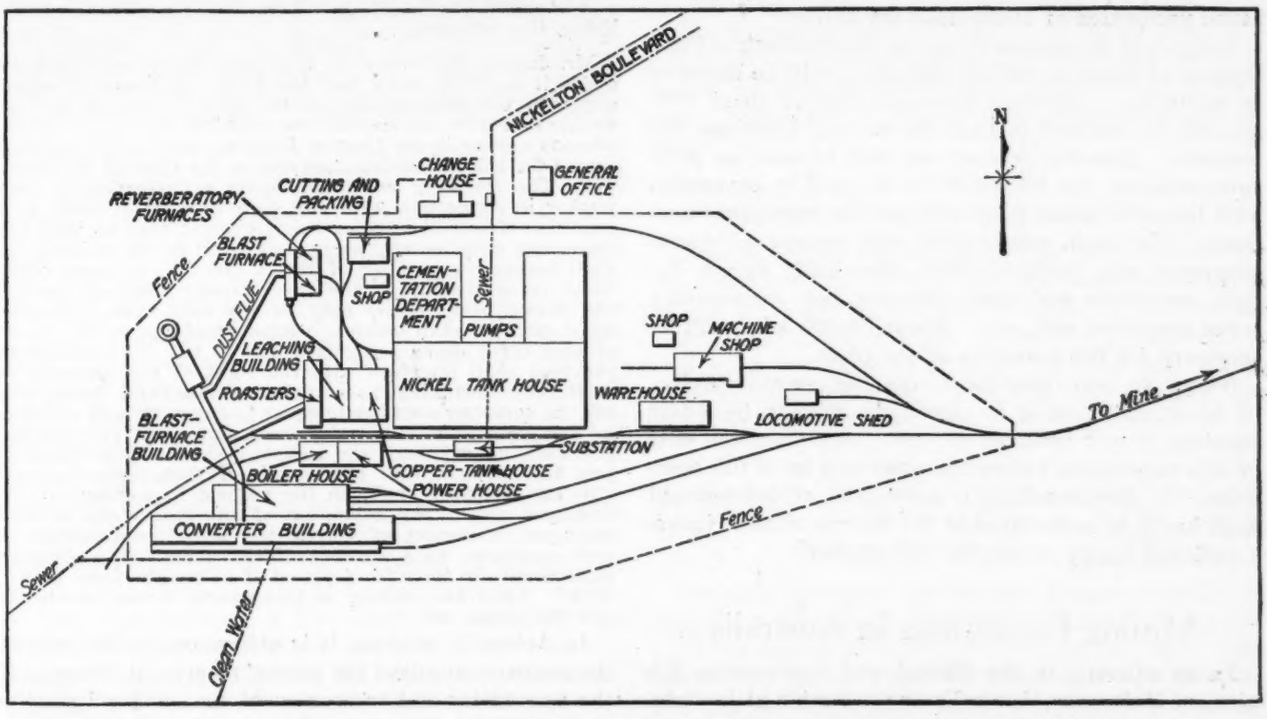
General Manager, British American Nickel Corporation, Toronto, Ont.

The British America Nickel Corporation is now constructing a 2500-ton smelting plant at Nickelton, Ont., four miles northwest of Sudbury; it will comprise four 25-ft. blast furnaces and seven 13 x 30-ft. Peirce-Smith converters. The refinery, which will be built adjacent to the smelting works, will use the Hybinette process and have a capacity of 10,000 tons of nickel per annum.

THE British America Nickel Corporation, Ltd., was most unfortunate in losing its chief promoter, Dr. F. S. Pearson, on the "Lusitania." The death of this captain of industry was a severe blow to the enterprise, and it was only after considerable effort on the part of Dr. Pearson's associates that the enterprise was refinanced and started off on a sound basis.

The corporation owns a considerable acreage of undeveloped nickel claims and has in the Murray mine great reserves of nickel ore developed by diamond drilling, to which are being added still further reserves by the diamond drilling which is now being done.

At first it was thought advisable by the new board of directors to build the smeltery near the mine and the refinery on the Niagara Peninsula, but when the present management investigated data, it was found expedient to change this plan and build the smeltery and refinery adjacent to each other on the site chosen for the smeltery in the first place. Preliminary work has been done, and a force of about 250 men is now at work putting in trackage and building foundations. The machine shop and warehouse are already up and in use. The site is connected by rail to the Canadian Pacific Ry. and the Algoma Eastern systems. The principal ore supply will be from the Murray mine, about one mile distant from the smeltery and connected therewith by standard-gage railway.



GENERAL PLAN OF NEW WORKS OF BRITISH AMERICA NICKEL CORPORATION AT NICKELTON, ONT.

The ore coming from the mine will be picked on picking belts and screened over ¾-in. grizzlies. The coarse ore will be smelted in blast furnaces to a 10% copper-nickel matte; the fines will be added to the converter charge.

The blast furnaces will be four in number, 25 ft. in length by 50 in. wide at tuyeres, but so arranged that if necessary they can be coupled together to give nearly double the hearth area. These furnaces are to be charged from both sides and will tap into the usual settlers, the slag being drawn off into slag cars and transported to the dump by electric locomotives.

The converter plant will be larger than usual and will consist of seven of the latest type of Peirce-Smith converters, with shells 13 ft. in diameter by 30 ft. long, outside measurements. These will be fitted with the Garr silica gun. A portion of the converter slag will be cast on the converter floor, broken up and used in the blast furnaces as flux. The remainder will be poured into the blast-furnace forehearths for settlement. The converter matte produced will contain about 80% copper and nickel, approximately 1% iron, the remainder being mostly sulphur. This will be granulated and taken to the refinery, where it will be roasted in mechanical furnaces of the Wedge type, then leached to extract the bulk of the copper, which will be recovered electrolytically, using insoluble anodes. The residue from the leaching will be melted down and cast into anodes which will be electrolyzed by the Hybinette process.

The attached plan gives a clear idea of the layout of the plant. Sufficient room has been left for extension in all departments. The smeltery building proper will be 160 ft. wide and 360 ft. long; the refinery building, 225 ft. wide by 400 ft. long. In addition to these buildings there will be provided shops, changehouse, clubhouse, laboratory, general office, warehouse, power house, substation, etc. The capacity of the plant to be installed will be about 2500 tons of ore per day, or a nickel production of 10,000 tons per annum.

Power will be secured from the Hydro-Electric Commission of Ontario, and all machinery will be operated by electricity. However, a steam plant of about 1000 hp. will be required to heat the various buildings and solutions. Steam-generator sets will be used as pressure reducers, the electricity to be used in connection with the main power plant and also for emergency purposes. The main power plant will consist of steam-generator sets, turbo-blowers, electrically driven for both converters and blast furnaces, air compressors, motor generator sets, etc. About 10,000 e.hp. will be necessary for the operation of the plant.

Owing to war conditions, causing great scarcity of labor and making it extremely difficult to obtain supplies, it will probably be two years from the date of this publication before the plant will be in full operation. In the meantime a great deal of development work has to be undertaken at the Murray mine to insure a sufficient supply of ore for the smeltery.

Mining Conditions in Australia

In an editorial in the *Mining and Engineering Review*, of Melbourne, Australia, is set forth a plain statement of what is happening to the mining industry of the Commonwealth while the politicians are telling what they are doing and what they have done to Germany. In brief, the article states that the copper producers of Australia cannot show very great reserves, the known zinc deposits are being rapidly worked out, Charters Towers, Bendigo, Gympie and Ballarat are moribund, and not a hand is being raised to stimulate the industry, while the government is talking of erecting huge metallurgical works to treat ores to come from goodness knows where. No inducement is offered to the miner, and during the controversy preceding the recent election not one word was offered on the need of encouraging the mineral industry.

On top of the continued agitation for a 44-hour week and the promises made by the labor agitators that a 40-hour week would eventually be secured (or bettered) comes the announcement in the *Queensland Government Mining Journal* that the English and Australian Copper Co. is prepared to receive offers for the purchase of its smelting and refining works at Waratah, N. S. W. Several properties in South Australia, formerly owned by this company, were recently compulsorily acquired by the government.

The curtailment of operations consequent to these acquirements is stated to be the cause of the intention of the company to dispose of its copper smelting and refining business, it being considered that under the altered conditions the Waratah works "can be more advantageously and economically controlled by Australian owners than by an English company."

The company has made a continuous and successful fight for its life for 45 years. Its Waratah plant was constructed in 1872, and the intention to dispose of the properties remaining, which "can be more economically and efficiently controlled by Australian owners than by the English company" is apparently the nice way of saying that it cannot exist under Australian labor conditions.

The *Queensland Government Mining Journal* publishes the following:

> Mr. Justice McCawley . . . then made an award, in which it was laid down that the following conditions shall apply to the employment by the Mount Morgan Co. of workers on work covered by the existing award for metalliferous mining in the Central Division, and by the existing award for the sawmilling industry in the Central Division: "(1) The company when employing or reëmploying any worker in connection with any such work shall make it a condition of employment, or reëmployment, that he shall not commence duty on any such work until he is, or until he shall become, a member of the A. W. U., or some other union recognized by it, and the company shall not permit any person to commence duty, or any such work, unless he is, or until he shall become, a member of the A. W. U., or of such other union recognized by it. (2) Nothing herein provided shall interfere with the right of the company to fulfill its undertakings to reëmploy nonmembers, if any, who left the company's service in order to enlist, or who enlisted, in the Australian Imperial Forces, but when reëmploying any such nonmembers, the company shall request them to join the union within one month of such reëmployment. (3) The company shall, on the request in writing of any employee, pay to the union, out of any money due to such employee in respect of wages, the actual contribution of such employee, as a member of the union. This decision shall remain in force for a period of 12 months from May 8, 1917." After the making of this award, it was decided to call the strike off.

In Article 3, whereby it is obligatory on the part of the company to collect the unions' moneys, it seems as if the secretaries and treasurers of the sundry branches of the A. W. U. were attempting to reduce their working hours. It would be interesting to know what the charges for administration of union funds amount to. In one district in New South Wales, where there were over 1000 members, it cost, according to their State Secretary Davis, 17s. 7d. to collect £1. Nice fund left for "benefits to workers?"

Development of La Africana Copper Mine, Lo Aguirre District, Chile

By Mark R. Lamb
Metallurgical Engineer, 30 Church St., New York.

This is the story as Don Guillermo told it to me himself. At the beginning of the development of the story it was not his habit to talk of it. About the only ones who talked of it were his "friends," who took every opportunity to tell him that he was all of the different kinds of fools that there are.

Once upon a time a Chilean civil engineer saw a prospect hole with little or no copper in it, but he liked the surroundings and the formation and the type of deposit, for you should know that our engineer was not altogether ignorant of mining.

He took what little money he had and some of his wife's (and this is where his friends took hold) and went to work to make the little prospect hole a larger one. He succeeded in this perfectly—and that is all he did do for many months and several years.

Meantime, funds ran low, and as absolutely no money is available in Chile for mining investments, the engineer was obliged to reduce his operations in proportion as the bottom of his money bags came into view. He was sinking an incline, with the idea of cutting the vein and the sinking cost more than he expected, so that quite naturally he was anxious to cut the vein before his funds ran out. Of course he went through the usual process of asking his friends and the banks for advances to be paid out of his profits, which gave them all the opportunity they wanted to tell him about himself as stated above.

HEADFRAME AND GENERAL MANAGER'S RESIDENCE (ON RIGHT)

Anyone in Santiago can tell you that Don Guillermo was on his last legs—had mortgaged his house and farm and spent all his money—when he struck the vein. I am almost afraid to tell you what he struck. He has been working it for years now, shipping the rich sulphide ores to Naltagua where they were urgently required—and urgently paid for, trust Don Guillermo for that!

He had many ways of getting the last cent out of the ore, and he needed it, for you see, although Naltagua needed his ore, no one else nearby needed it, so that it was a question of selling to Naltagua or paying heavy shipping charges.

One day, during my early days in Chile, I received a call from Don Guillermo, who told me all about his mine and asked for a price on a smelting plant for his ore. He told me of his arrangement with Naltagua, but said that they did not pay enough for the ore, and he would have no more to do with them.

Of course it was a pleasure to quote him and I knew he was perfectly good for the plant, because he was making over $30,000 a month from his shipping ore. Think of it—when copper was worth 13c. a pound.

Well sir, you can imagine that I hurried up the estimate and was ready in short order, but Don Guillermo held back and hestitated and delayed, and I couldn't make it out. Meantime I had thoughtlessly mentioned the matter to Mr. Lehmann, of Naltagua, which was just what Don Guillermo had planned! I said "thoughtlessly," but should make it clear that the thoughtlessness was only on the part of Mr. Lehmann and myself. The plant was not put up, but the price of the ore was.

The illustration gives you an idea of the equipment on the mine. Did I say "equipment"? There ought to be a special word for the junk on that mine. The hoist consisted of a hand winch fitted with a wabbly pulley and belted to a 10-hp. oil engine. Hoisting was begun by starting the engine and then throwing the belt on, and lowering was accomplished by throwing off the belt and holding a foot against the pulley.

I forget how many inches an hour was the speed of the rope, but I do remember that the children tied a string to the cable while it was running, and after watching it until it reached the sheave, we walked around the house and waited until it reached the hoist. The mine production at that time was about 50 tons in 24 hours, and was limited, not by the vein, which is several meters wide, but by the hoist.

The mine, when Don Guillermo sold to the Andes Exploration Co., was far and away deeper than when he struck his vein during the early years of the mine—I think it has now reached a total depth of nearly 90 feet!

British Iron and Steel Trade

Imports of iron ore and scrap into Great Britain for the five months ended May 31, were valued at £10,312,752 in 1916, and £11,005,800 in 1917; an increase of £1,306,952. The quantities of iron ore are not stated.

Imports and exports of iron and steel and manufactures thereof for the five months ended May 31 are valued by the Board of Trade returns as follows:

	Imports		Exports	
	1916	1917	1916	1917
Iron and steel	£4,247,437	£3,324,501	£23,826,285	£19,574,960
Machinery	3,524,679	3,281,961	5,850,686	7,009,394
Hardware, etc	315,947	135,783	3,269,802	2,959,061
New ships	.....	.....	299,043	504,092
Total	£8,088,063	£6,742,245	£33,245,816	£30,047,517

The total volume of iron and steel imports was 323,248 gross tons in 1916 and 168,687 tons in 1917; of exports, 1,572,704 tons in 1916 and 1,016,686 ton this year. The statistics in the reports as published have been curtailed this year, no figures for countries of origin or destination being given.

The imports for the five months show a decrease of £1,345,868 this year, and the exports a decrease of £3,198,304. The excess of exports over imports was £25,157,703 in 1916, and £23,305,267 this year. Reëxports of foreign iron, steel, etc., not included above were valued at £1,064,529 in 1916 and £747,151 this year.

Mining Methods at Magpie Iron Mine*

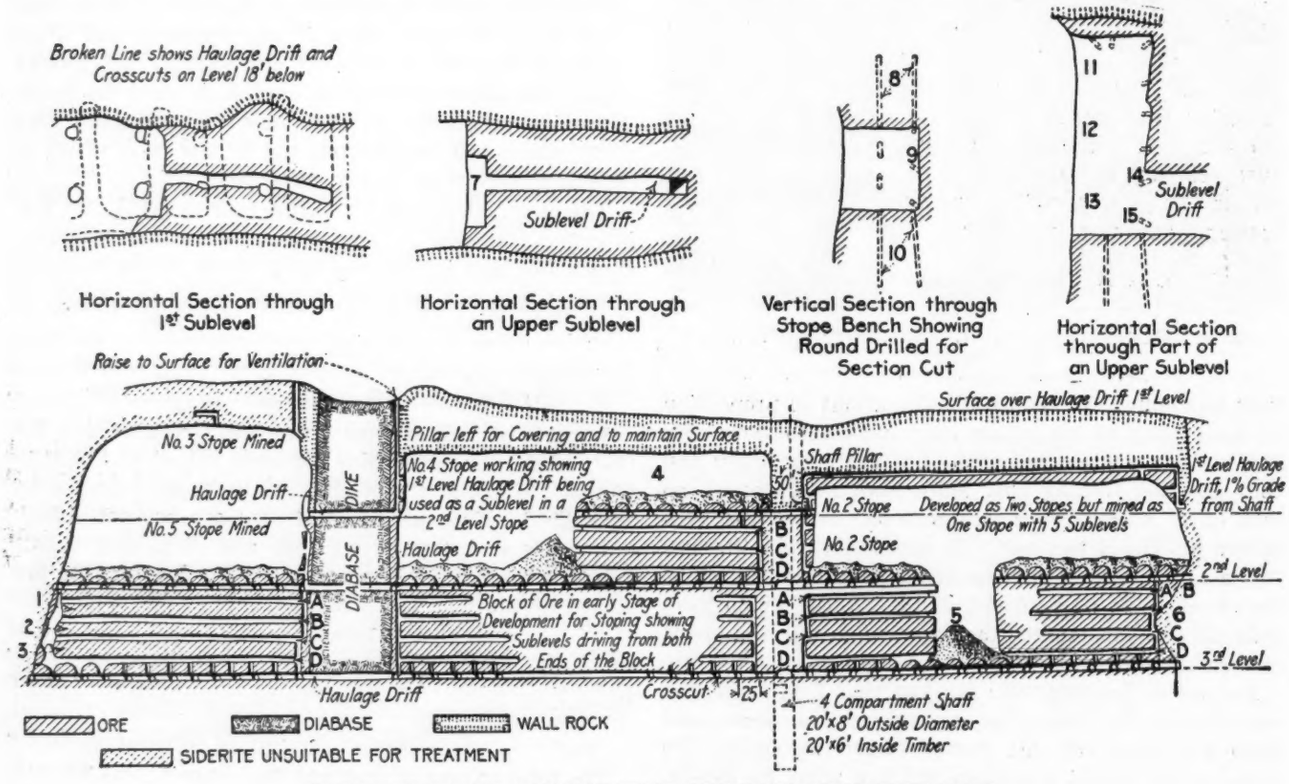
A body of siderite in Ontario, containing many slips and cleavages, made it necessary to keep the men close to the backs of the stopes. Sublevels are run between levels, the stopes being cut back from each subline at the same time, keeping the stope face the full height of the distance between lines. "Mackinaws" used in place of cross switches, and skips are loaded while hanging on the cable, no chairs being used.

AT the Magpie mine, Michipicotan district, Ontario, is a body of siderite. It is now being mined and made into a merchantable ore by roasting. This roasting, which is done in cement kilns, drives off the volatile and at the same time reduces the sulphur to a point suitable for the blast furnace.

The siderite, together with the other carbonates, occurs as a band standing nearly vertical and striking northeast and southwest. The band is broken by folding and faults at several points. The width of the siderite that is being mined ranges from 28 ft. to 62 ft.; the average width is about 42 ft. The carbonate deposit, as a whole, is a sedimentary bed lying between a series of acid and basic flows and tuffs of volcanic origin. The wall rock on the south is a talcose schist with well-defined schistosity; while on the north it is an ellipsoidal basalt showing very little schistosity. The contacts are not well defined and are not clean, so that much care is necessary in mining to make sure that no ore is left on the wall and that no rock is broken into the stopes. The schist on the south wall underground has the appearance of the ore, but the drill cuttings from the holes give a good indication of when the wall has been reached. The body being mined has an approximate length of 1350 ft. The carbonate band is much longer than this, but narrows down on either end so that it is not found profitable to mine the ore except in this area.

The siderite, as a whole, is the usual light-colored ore having a slightly pink tinge due to the presence of manganese carbonate rhodochrosite; but on either side of the diabase dike, cutting the body, the siderite is dense-black ore very much resembling fine-grained magnetite. In the white siderite the volatile runs about 32%, but this gradually decreases near the dike until it is as low as 12%. The carbonate here contains magnetite in considerable amount and the iron contents of the ore are higher than in the light colored ore. The black ore is exceptionally hard, so hard in fact that a 3¼-in. piston drill will drill only from 5 to 6 ft. of hole per shift. The character of the ore changes gradually as the distance from the dike increases, so that at about 100 ft. from the dike the siderite is all white.

In roasting the siderite at the Magpie there is a loss in volatile of about 30% by weight, so that nearly three tons of ore must be mined to produce two tons of finished material. Taking this into consideration, together with the fact that the actual roasting operation costs are considerable, it was necessary to devise a


Broken Line shows Haulage Drift and Crosscuts on Level 18' below
Horizontal Section through 1st Sublevel
Sublevel Drift
Horizontal Section through an Upper Sublevel
Vertical Section through Stope Bench Showing Round Drilled for Section Cut
Sublevel Drift
Horizontal Section through Part of an Upper Sublevel
Raise to Surface for Ventilation
No. 3 Stope Mined
Haulage Drift
No. 3 Stope Mined
DIKE
DIABASE
Pillar left for Covering and to maintain Surface
No. 4 Stope working showing 1st Level Haulage Drift being used as a Sublevel in a 2nd Level Stope
Haulage Drift
Block of Ore in early Stage of Development for Stoping showing Sublevels driving from both Ends of the Block
Haulage Drift
Crosscut
Surface over Haulage Drift 1st Level
Shaft Pillar
No. 2 Stope
Developed as Two Stopes but mined as One Stope with 5 Sublevels
No. 2 Stope
1st Level Haulage Drift, 1% Grade from Shaft
2nd Level
3rd Level
4 Compartment Shaft
20'x8' Outside Diameter
20'x6' Inside Timber
ORE
DIABASE
WALL ROCK
SIDERITE UNSUITABLE FOR TREATMENT

HORIZONTAL AND LONGITUDINAL SECTIONS OF MAGPIE MINE

*Paper presented at the Montreal meeting of the Canadian Mining Institute, March, 1917, by A. Hasselbring, general superintendent, mining department, Algoma Steel Corporation, Magpie Mines, Ontario, Canada.

cheap mining system in order to make the operation commercially successful. Several mining methods were studied and approximate costs worked out; but before any method was definitely chosen, it was decided to sink the shaft and open up drifts on two main haulage levels to definitely determine the nature of the ground and the material to be mined. The shaft was accordingly started on the north side of the orebody, about 60 ft. from the north contact of the ore. The shaft is 24 x 8 ft. in the rough, and is timbered with 12 x 12-in. sets, so that the inside dimensions are 22 x 6 ft. It is divided into four compartments, two skip compartments for balanced Kimberly skips, one cage compartment and one ladder and pipe way. The shaft was sunk 205 ft. to the second level, it having been decided to cut 80-ft. levels and to leave a 45-ft. floor pillar on surface. A crosscut was run on each level from the shaft to the south contact of the ore, and drifts started thence in either direction. These drifts follow the south contact as nearly as possible. The nature of the ore passed through in the drifts was closely observed and samples taken and analysis made for each 10-ft. section of the drifts. No timber was necessary in any of the drifts, but it was noted that the ore showed a great number of slips or cleavage planes. These slips have no general direction but intersect one another at all angles and are extremely smooth. In scaling a new drift, large wedge-shaped pieces will fall out from the first blow of the scaling bar; but when a drift is once thoroughly scaled, little material loosens from later blasting. On account of this feature of the ore, it was necessary to decide on a method of mining that would keep the miners always close to the back and under cover. It was therefore decided to use the sublevel stoping system in mining this deposit.

Orebody Divided into Three Stopes

The orebody was blocked off into three stopes longitudinally, divided opposite the shaft by a 50-ft. shaft pillar and 400 ft. west of the shaft by a diabase dike 100 ft. wide, which cuts the body at right angles. This gives three stopes on each level, approximately 400 ft. long. To develop these stopes, a raise is made at each end of the block, and sublevels run to connect the raises, The first sublevel is 18 ft. above the level; the others are 23 ft. from floor to floor. On the upper levels three sublevels are used between levels, but below the second level four sublevels are used, making the distance between levels 103 ft. After the stopes have been developed in this manner, the raise at the end of the block nearest the shaft is made into a permanent ladder and pipe way.

Air lines are carried along the floor of the sublevels to the far end and mining commenced. Machines are employed in breaking down around the raise at the far end of the block, and this opening is enlarged until the stope is completely cut off. The first sublevel is then drawn back about 50 to 60 ft. By keeping the first sublevel back this distance, the muck does not run into the face. This also gives the men working on this sublevel a chance to sandblast a proportion of the larger pieces which break from the upper benches. Most of these drop so that they can be reached from the first sublevel, but those dropping in the open stope have to be blasted as they come down into the chutes.

After the stope has been cut off from wall to wall, section-cutting is done on each sublevel. At first it was the intention to carry the sublevels step fashion with the upper sublevels overhanging the lower ones, but the ground was found to be so full of cleavage planes that these overhanging benches fell when blasting out the section cut, so that now all the sublevels except the bottom ones are carried back together, the face of the stope being vertical. In section-cutting the stope, the machine is set up in the sublevel and an 8-ft. bench blasted off. This requires five holes, two in front and three behind. These holes are about 7 ft. deep and break to the bottom. Little mucking is necessary for the next set-up, and there is little scaling, as the back is only 8 ft. high. This section cut is carried from wall to wall, and the stope holes are drilled in the bench below from the same set-ups. The back holes are drilled with stopers after the section cut has been completed. The whole face of the stope is then blasted off with a battery shot. Little powder is required, either in the section cut or in the stope blast, as there is always an open face to break to. When a stope on one level has been drawn back to the starting raise, the chutes are taken out, rails and pipe lines are removed and the main level is used as a sublevel. In this way all mucking is avoided, the ore remaining in the bottom of one level which will not run out of the chutes being dropped to the level below. On the bottom sublevel no back holes are used, except in the corners of the stope, as this sublevel is carried higher than the others, thus leaving a thinner block of ground between it and the second sub. The rail and pipe lines, removed from the level which is drawn back, are used on the lower level in the development work, so that very few new pipes or rails are required.

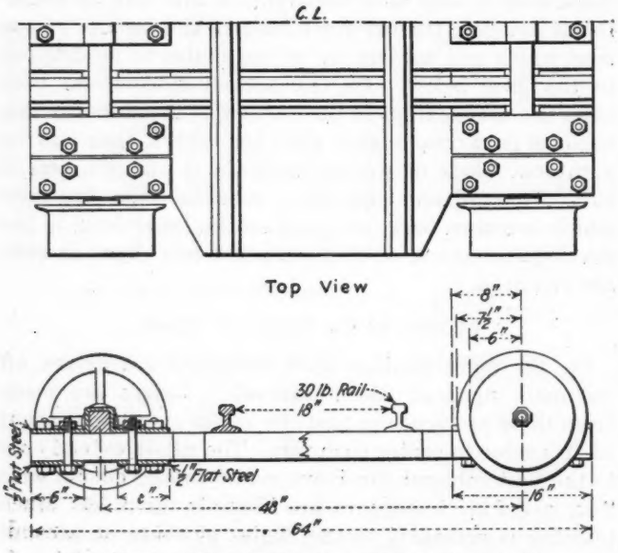
Crosscuts on Haulage Level

On the main haulage level, crosscuts are driven off the main drift at 25-ft. intervals. Raises are made from these crosscuts so that the raises are spaced about 25 ft. center to center each way. The raises extend only to the first sublevel. Ordinary round-timber chutes with 3-in. round birch stoppers, are in use in the raises. Much blasting is necessary in the chutes at times on account of the benches falling in large pieces, but otherwise no trouble is experienced in loading cars. All tramming is done by hand, two-ton cars being used on a grade of 1% in favor of the loads. Cross switches for spotting cars at the shaft have been discarded. In their stead a track, running on rails in a shallow pit transversely across the station and about 12 ft. back from the shaft, is employed. Cars can be pushed on this track from any track and spotted for either the skip track or the cage track as may be required. All outbound loaded cars come up the main crosscut on the one track. The "mackinaw," if not in use, is spotted for this track. The lead for No. 1 skip lines with this main line. Cars to dump in No. 1 skip come up the main, cross the mackinaw to this lead and dump directly in the skip. Returning, they are backed on the mackinaw, which is then spotted for the return track, and shoved down the return track through a spring switch out on the main line and back in again for loading. This spring switch is the only switch on the level. Ordinarily trammers dump their own cars, but when for any reason it is

necessary to speed up the hoisting, dumping is done by a gang of dumpers (two men) at the shaft. Trammers coming out leave their cars on the main line and go back with an empty from the return track. The gang at the shaft handle cars on the "mackinaw," dump them and shove them down the return track. Working in this way, 400 to 450 skips can be sent up in a shift.

Ore Hoisted in Two-Ton Balanced Skips

The ore is hoisted with two balanced Kimberly skips, which have a capacity of two tons each and dump directly into the crusher. The hoist consists of a 6-ft. drum, coned at each end and geared to a 150-hp. wound-rotor three-phase induction motor. This motor is remotely controlled and automatically protected against overloading. It is only, of course, when hoisting from the bottom level that the cone on the drum is of any use, but the motor has no difficulty in starting a loaded skip from any of the intermediate levels, even though no chair is used and the full load is hanging on the rope at the start. The full-load speed of the motor gives a rope speed of 750 ft. per min. The signal to hoist the skip is given to the hoistman by a bell which can be rung from only one level; namely, the one from which



TRANSFER CAR USED AT THE MAGPIE MINE

the most tramming is being done at that time. A skiptender is stationed there and the other levels ring to him when they want the skip or when they have finished dumping their car; he then relays the signal to the hoistman. The crusherman feeding the No. 8 crusher also has a switch by which he can ring the hoistman in case of trouble in connection with the crusher and when he wants to stop the skip before it dumps. This switch also gives the same signal to the skiptender, so that he knows that the skip has been stopped at the crusher. This stopping for a minute or two is fairly frequent, as a big chunk of ore often has to be broken with a hammer before it will go into the crusher. The skips dump into a No. 8 gyratory crusher which breaks the ore to about 6-in. ring. The black ore from near the diabase dike is, as stated previously, exceptionally hard, and it was found that the cast-iron spider, which is practically always supplied with these machines, was not strong enough to withstand the strain of breaking it and had to be replaced by a cast-steel one. Below the No. 8 crusher the ore passes over a set of grizzly bars and then to two No. 5 gyratory crushers. These are set to about 3 in. and from them the ore is carried on a 24-in. belt to storage bins in the roast plant.

The roasting kilns are 8 ft. x 125 ft. and lined with 9-in. hard firebrick. The fuel used is powdered slack coal which gives a temperature of about 1100° C. for about 20 ft. in the kiln. This is not hot enough to make the ore sticky and is sufficient to drive off the CO_2 and eliminate nearly all the sulphur.

After passing through the roasting kilns, both the light- and dark-colored ores have the same appearance and are not distinguishable in any way. The finished ore is nearly black in color, and comes out of the kilns in a porous condition in rounded lumps about 2 in. in diameter, the large pieces breaking up when passing through the kiln. This finished product has the following composition: Iron, 50.00%; phosphorus, 0.013; silica, 9.60; manganese, 2.75; alumina, 1.24; lime, 7.69; magnesia, 7.75; sulphur, 0.196; loss on ignition, nil. The product is suited for the blast furnace both on account of its physical condition and its chemical composition.

Research Corporation's Report

The organization and development of a corporation, unique in that its charter provides that no dividends shall be paid on its stock, is described in a booklet just issued by the Research Corporation of New York.

When Dr. Cottrell offered, in 1911, to give the Smithsonian Institution extensive rights in his patents on processes of "electrical precipitation of suspended particles" in order that any profits they might earn might be spent on scientific research, the proposition was recognized, says the booklet, as generous and original.

However, for administrative purposes the Research Corporation was substituted for the Smithsonian Institution as custodian of the patents with the responsibility of furthering their technical and commercial development. This corporation has aimed, to quote its own words, to serve as an experimental laboratory in practical economics where altruistic considerations need not be subordinated to the necessity of paying dividends, the primary and controlling consideration being the ascertainment of the most practical and effective means of developing the industrial arts.

Demonstrations to determine the practical value of the patents have been made, since the corporation's birth, with such success that in most cases the companies that permitted tests to be made have sought to secure permanent installations. The corporation now has a staff of 45 engineers, and its monthly expenditure equals its original cash capital. Installations of the processes are in successful operation in 20 plants, including those of the American Smelting and Refining Co. at Garfield, Maurer and Omaha. The corporation's assets, as reported in February, 1917, in cash and securities were $217,862.72.

A laboratory has been established, and experts have been employed to improve the processes if possible. The corporation feels that there is need of an organization that can act as intermediary between inventor and manufacturer and that can test discoveries or inventions and render a trustworthy opinion to the manufacturer.

Molybdenite and its Occurences

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The demand for molybdenum, of which molybdenite is the chief ore, has greatly increased since the beginning of the war, and prices have risen in proportion, thereby greatly stimulating production. Canada, the United States and Australia are the chief sources of supply. Molybdenite is widely distributed. It is of secondary origin and is commonly found in granites and granite-pegmatites. Contact-metamorphic deposits containing no copper are promising sources. Molybdenite occurs in small amounts in basic igneous rocks and occasionally in sedimentaries, though not characteristic of either.

MOLYBDENUM is one of the metals which through broader use in the future will probably benefit from the war. At present the world's consumption is small, and its value scarcely equals that of the output of a fair-sized mine. These notes are compiled to direct attention to the geological occurrence[1] of molybdenum ores, and their perusal will indicate that molybdenite prospectors should confine their efforts to granite countries, and more particularly to the bounding zone of the granite masses and the rocks they intrude.

The metal in small quantities is consumed by the electrical and scientific instruments trade. Its salts form chemical reagents, preservatives for explosives, pottery colorants and medicines. Molybdenite itself is reported to be suitable for lubricating purposes, but practically all of the world's production is used, with or without tungsten, nickel, chromium and cobalt, in making steel-alloys for cannon, armor plate, tool steel, automobile parts, and crank- and propeller-shafts. Its use in tool steel does not appear to be increasing, but the automobile industry will perhaps in the future consume a large amount.

Molybdenum's Value as a War Metal

Even before 1914 its war value was indicated by the fact that Krupp of Germany, and Creusot of France were the principal consumers. The Germans have found that 3 or 4% of molybdenum greatly increases the life of their heavy artillery and of their rifle barrels. The present large consumption by the Allies shows they are using the metal in some similar way. Indeed, the British Empire does not permit the export of the metal or its alloys or ores even to its allies. Prior to the war France and Germany reduced most of the ore to metal, but now England, Canada and America are making both molybdenum and ferromolybdenum.

The recently increased production, by assuring the steel men an adequate supply to warrant experiments, will doubtless stabilize the market and create a regular demand for the ore. In the past with an increase in price, certain deposits have been feverishly exploited and, with a fall, as suddenly abandoned. To date, the better-established production basis of tungsten, the ownership or control of tungsten mines by some of the makers of steel-alloys, and the ownership by the Crucible Steel Company of the important Holcomb patents have not tended to increase the use of molybdenum, the chief competitor in many ways of tungsten.

The figures of the world's production of molybdenum ores are more or less unsatisfactory, but it appears that the output from 1902 to 1915 increased in quantity about 10 times and in value still more. In 1910 the production, valued at about $120,000, was about 210 tons, of which Queensland produced over one-half, New South Wales and Norway each almost a quarter, and Sweden and the United States a little. Prior to the war the United States produced negligible quantities of molybdenite, but in 1914 and in 1915 various small molybdenite mines sprang up in Colorado, New Mexico, Arizona, Maine, Utah, California, Montana, Nevada, Texas and Washington. In 1915 for the first time the United States became the most important producer. F. L. Hess gives the world production for 1915 as equivalent to 222.6 tons of metal, and the 1916 output was perhaps twice as great. In 1916 Canada became an important producer, as a number of mines were opened in Ontario and Quebec, and the British Columbia production notably increased. In 1917 Canada will doubtless take the lead in the world's production.

Prices Have Advanced Rapidly

From 1910 to 1913 molybdenum was worth from $1.40 to $1.50 per lb., but soon after the war even $6 was obtained for small quantities. In April, 1916, the price was $3 to $4 per lb. Ferromolybdenum is quoted per pound of molybdenum contained, 50% to 80% of the metal being present in the alloy. The price is practically that of metallic molybdenum, and now is $4.25 per lb. of molybdenum content.

Molybdenite prices are quoted on a 90% MoS_2 product, 50% ore being worth approximately half as much and 95% ore about one-fifth more. When stocks are short, 20% concentrates are sometimes salable, and it would appear that a concentrate, lower in grade than the 90% usually required, could be handled readily by the smelters. Copper, arsenic, tin, bismuth, antimony, tungsten, calcium, barium and phosporus are injurious impurities, more than 2 or 3% of the first rendering the product unsalable. Tin and bismuth may be present up to 0.5%, without the ore being penalized. From 1902 to 1911, the price varied from $400 to $625 per ton; during 1912, from $900 to $1000 a ton. In 1914 it jumped, on account of heavy German buying and the opening of the war, to $2000, and since then has fluctuated from about $2000 to $3600. The latter is the present quotation, the demand being good. In

[1]For more data see F. L. Hess, "Mineral Resources of the United States," United States Geological Survey; also Frederick W. Horton, United States Bureau of Mines, Bulletin 111, 1916.

October, 1915, the British Empire, through the Australian government, acquired the Australian production at a uniform price of $25.20 per unit of MoS_2, a 90% product being required. The Canadian production has been similarly commandeered, the buying agent being the Imperial Munitions Board at Ottawa. It is of interest to note that in 1916 the Dominion Mines Department was operating at Ottawa the largest molybdenite mill in Canada. On July 19, 1916, Japan prohibited the export of tungsten and molybdenum without a license.

Molybdenite is much the most common ore, and, with the exception of wulfenite, the only commercial source of the metal. The demand for and price of wulfenite (lead molybdate) is most variable, as, on account of its chemical composition and the impurities usually present, it is not a particularly desirable ore. In 1912 wulfenite containing at least 25% molybdic trioxide was worth $100 per ton, and after the war began the price doubled. Since then some sales have been made at $300 per ton. Wulfenite should contain at least 25% of molybdic trioxide, and at worst a low copper content. Arsenic, bismuth, tungsten, vanadium, antimony, chromium and phosphorus are also highly objectionable. Wulfenite, like most of the other molybdenum minerals except molybdenite, is a product of oxidation.

Characteristics of the Molybdenum Minerals

Molybdite, a hydrous ferric molybdate (a little over 39% Mo), is not rare at the surface as a yellow stain or yellow earthy powder upon the outside or along the cleavage planes of molybdenite. As the sulphide is, however, relatively resistant to oxidation, molybdite does not occur in commercial quantities. Its brilliant color is, however, a valuable indicator in molybdenite prospecting and mining. There is no evidence that enough molybdenum is taken into solution to form secondarily enriched deposits, although molybdenite is undoubtedly altered at the surface to numerous oxidized minerals, and, locally at least, outcrops show casts of molybdenite crystals, and the presence of molybdenum in the mine waters of Idaho Springs, Colo., has been proved.

Wulfenite (a little less than 40% Mo_3) occurs in shiny yellow, orange or red tablets and is brittle, soft and heavy. Practically all the molybdenum ore produced in the United States prior to 1915 was wulfenite. It is a rather common mineral in the oxidized portions of lead-bearing orebodies. In North America it is one of the more characteristic desert minerals and in commercial quantities is practically confined to the arid region of the Southwest and Sonora and Chihuahua. Humid Japan, however, produces considerable quantities. Vanadinite and cerrusite are frequent and troublesome associates.

The name "molybdenite" (59.95% Mo) was first given to substances containing lead, but later graphite, molybdenite and certain antimony compounds were confused under the name. Molybdenite was only differentiated in 1778-9, by Scheele. The confusion of graphite and molybdenite by the early mineralogists is not surprising. The two occur as soft, black, metallic-lustred scales, frequently of hexagonal outline, and both are frequently associated with pegmatites and light-colored gneisses. Molybdenite, however, has a bluish caste which graphite has not, and of course is much heavier (sp.gr. 4.7). Moreover, its lead-gray streak has a greenish tint, and heated in an open tube it gives off sulphurous fumes. In the field, if alteration has taken place, the yellowish color of molybdite is diagnostic.

No molybdenite mine should be opened unless a 90% concentrate can be produced for from $800 to $1000 per ton. If the world's production should suddenly increase, the price might temporarily fall even below the former figure, but probably would eventually exceed it. Ore occurring in fair amounts and carrying 2% or even 0.5% MoS_2, if all factors are favorable, can be profitably treated. At present the price is about treble that of tungsten ore, but such a discrepancy is not justified, and eventually the price of the two ores will probably be more nearly equal. Over-estimation of the richness of molybdenite ore, like that of copper, must be guarded against, as molybdenite in white quartz is rather showy.

Distribution of Molybdenum

Hillebrand[2] by chemical analysis found molybdenum present in the more siliceous rocks including rhyolite, granite, quartz-mica-diorite and monzonite. These rocks are its normal habitat, but the element is not unknown in basic rocks. Molybdenum is about as abundant a constituent of the world's crust as tungsten and bismuth. I am inclined to believe it may be more common than tungsten, but, like it, the high-grade oreshoots are small and erratic. On the other hand, low-grade molybdenite deposits which might form the basis of large mining operations are more common than those of the tungsten ores. This statement applies particularly to some granite orebodies. In the periodic law it occupies a place in the same group with its common associate, tungsten, and also with chromium, with which it has no common features of occurrence. The most common metallic elements in association with it are tungsten, tin and copper; less commonly, gold and bismuth. The relatively common association with tellurium and certain rare earths is worthy of note.

The principal ore, molybdenite, is widely, although in most cases sparingly, distributed. Its crystals or aggregates are usually rather small, but in instances crystals several inches across occur. Coarse and large crystals seem confined to occurrences formed at great or intermediate depths. It occurs in practically every country, but perhaps as a continent Australia is particularly rich in molybdenite. It occurs in granitoid and porphyritic rocks, particularly those of the granodiorite, monzonite and granite families, but is especially characteristic of pegmatitic and aplitic facies of these rocks. It is also common in orebodies of pegmatitic affinities and of veins of moderate or deep-seated origin. Tungsten deposits and quartz veins have to date yielded over three-fourths of the world's production, while pegmatites, bismuth and tin deposits have produced small amounts.

Molybdenite is a common constituent of granites, particularly those that are quartz rich and biotite poor (alaskites) and hence consolidated from a magma

[2]United States Geological Survey, Bulletin 167, pp. 49-55.

rather rich in mineralizers. In many cases, at least, the molybdenite was introduced after the granite had solidified, although Schrader and Hill consider that original which is sparingly present in the pre-Cambrian granite of Providencia Cañon, Ariz., and Laney likewise believes it of the molybdenite of the silicified pyrite-bearing biotite-granite of Loomis, Washington.

F. C. Calkins[3] also describes the original occurrence of molybdenite on the property of the Molybdenum Syndicate, about 40 miles northeast of San Diego, Calif. The country rock is biotite-granite, cut by many aplite dikes. One of these which contains molybdenite is from 50 to 200 ft. wide and has been traced for a distance of 1500 ft. The ore is most irregularly distributed in the dike, the greater portion being barren. Where the aplite, in irregular masses, grades into a coarser pegmatitic rock, molybdenite is relatively common. The crystals rarely exceed ½ in. in diameter.

Charles Drysdale[4] describes the Molly mine in Lost Creek, near Salmo, B. C., which in part may be considered typical of the occurrences in which molybdenite has been introduced after the granite solidified. At this deposit, discovered in 1913, the molybdenite occurs around the periphery of granite, intrusive in Carboniferous schist and limestone. The chilled outer edge of the granite, some 6 ft. wide, is an aplite, containing a few scattered molybdenite grains. Within this is a 10-ft. zone of highly jointed granite. Reticulating veinlets of molybdenite cross from joint to joint, and molybdenite also impregnates the intervening granite. Pyrite and pyrrhotite are associated. Molybdenite is also a constituent of the contact metamorphic limestone on the granite order. It is not unusual to find granite in other localities between molybdenite-quartz or pegmatite veins similarly specked with molybdenite. Such molybdenite-impregnated granites appear promising if the market becomes such as to justify mining on a large scale. Recovery will be low, as the mineral tends to slime and the separation of mica is difficult.

Occurrence of Secondary Origin

Molybdenite in granite-gneiss and schist is at least usually of secondary origin, and it is doubtful if it ever represents an original constituent of the unsheared granite. Molybdenite in this form occurs at several localities in the United States, and the granite-gneiss at the important Norwegian mines of Kvinas and Knaben likewise contains disseminated molybdenite. Perhaps closely related to the younger molybdenite of certain granites is the molybdenite filling the interstices of brecciated veins in granitic rocks and disseminated in the brecciated fragments. From Frederick W. Horton's descriptions, the Empire, Colorado, and Chico, Hot Springs, Mont., occurrences belong here.

Iddings[5] states that molybdenite also occurs in syenites and nepheline syenites, and their pegmatitic facies. Molybdenum is reported by Cross from the trachyte obsidian of Puu Waawaa, Hawaii.

The most common habitat of the mineral is probably the granite pegmatites, coarse-grained rocks formed perhaps both by hot magmatic waters and vapors. Naturally, the country rock is usually granite or granite-gneiss. An interesting association is that of molybdenite in pegmatites with ores of tantalum and the rare earths in Yancey County, N. C.; at Bluffton, Llano County, Tex., and at Ivigtut, South Greenland.

Part of the ore of the important Norwegian mines, Kvinas and Knaben, is clearly pegmatite, and along the strike it grades into molybdenite-quartz. At both localities the granitic country rock between the veins contains scales of molybdenite. In the latter mine some rather large pockets of molybdenite occur. J. A. Dresser[6] says that the ore in at least one of the pits of the Wood mine at Quyai, Que., the chief Canadian producer, occurs in a fluorite- and pyrite-bearing pegmatite. The Cooper, Maine, occurrence is, according to G. O. Smith and F. L. Hess, a quartz-feldspar-pegmatite containing also fluorite and a little native bismuth. Molybdenite is particularly abundant in the more quartzose portions of the pegmatite. Molybdenite also impregnates the inclosing granite. F. W. Horton,[7] describes the property of the Romero Mining Co., near Porvenir, San Miguel County, N. M. Molybdenite and chalcopyrite are closely associated in pockets in a quartz-feldspar-biotite-fluorite pegmatite. A little scheelite and bismuthinite also are present. The country rock is an alaskitic granite.

The pegmatitic occurrences show many gradations to other molybdenite orebodies. The Norwegian deposits, like many others, grade from pegmatites to quartz veins; the auriferous pegmatites of the Pas, Manitoba, composed of orthoclase, quartz, tourmaline, molybdenite, pyrite and chalcopyrite, connect the pegmatites with the gold- and copper-bearing veins. The Summit County, Colo., quartz-feldspar-chalcopyrite pegmatite, and the bornite-chalcopyrite-feldspar-beryl-molybdenite pegmatite of the Lillian mine, Greenland, are equally closely related to the cupriferous molybdenite veins. Tungsten- and bismuth-bearing pegmatites are common, and those containing tin also occur. These pegmatites are scarcely as promising sources of molybdenite as the closely allied quartz veins. In instances, however, the content is high and the coarse grain of the rock and the clearness with which the ore breaks from its matrix facilitate hand sorting.

Orebodies Small but Frequent

Quartz-molybdenite veins and irregular bodies are important sources of the ore. Granite, or its gneissic form or some rock in the immediate vicinity of a granite mass, is the country rock. While these orebodies are of small tonnage and frequently of most irregular form, these disadvantages are offset in part by the large number of bodies usually found in a district. Accessory minerals or geological relations prove the dependence of these orebodies upon granitic intrusions. In addition to disseminated scales, molybdenite may form nests of considerable size. Its distribution is, as a rule, bunchy. Pyrite and, in instances, chalcopyrite are frequently present.

In sheeted rocks (granite-gneiss, for example) the molybdenite veins have their extension parallel to the walls of the inclosing veins, and in many cases at least

[3]United States Geological Survey, Bulletin 640, pp. 73-6, 1917.
[4]Bulletin of the Canadian Mining Institute, November, 1915.
[5]Iddings, "Igneous Rocks," Vol. 1, p. 69.
[6]Colorado Mining Institute, March, 1917.
[7]United States Bureau of Mines, Bulletin 111, pp. 78-9.

the borders are unusually rich. A considerable portion of the Norwegian production comes from such veins.

In massive granite the veins may occur in joint fractures, as at the Crown Point mine, Washington, or in faults as south of Tucson, Ariz., or in pipes, characteristic of important Australian deposits, which usually contain in addition tungsten, tin or bismuth. The filling of some of these pipes grades from siliceous granite through pegmatite to quartz. The quartz-molybdenite veins and irregular masses frequently have a comparatively high molybdenite content, and milling is as a rule easy because the coarser varieties may be hand-sorted and the finer may be successfully milled as troublesome substances are not abundant.

Tin, Tungsten and Bismuth Deposits a Source of Molybdenite

Molybdenite is a common accessory in tin deposits, which have produced some of it as a byproduct. Most tin deposits are of pneumatolytic origin, and in instances they are true pegmatites. Those containing molybdenite are interesting because of the other metallic susbtances present, which show gradations to other types. Such deposits occur in the following localities: Erongo Mountains, in what was formerly German Southwest Africa, containing also tantalum and lithium; New England district, New South Wales, bismuth and tungsten; Cornwall, copper; Saxony, lead and gold; Indo-China, bismuth, lead and copper; Caiaria, Mexico, tungsten and lead; Huayna Potosi, Bolivia, copper, iron, galena and bismuth. While of pneumatolytic origin, the casual rock at the latter two places is quartz-porphyry.

Ores of tungsten and molybdenum are closely associated, and the latter is an accessory in practically every wolframite deposit, and it is not rarely present in scheelite deposits. These are either pegmatitic veins or veins deposited by hot magmatic waters usually at great depth, the waters being derived from granitic intrusions. Wolframite, molybdenite and bismuth are obtained from orebodies in the gray biotite-granite of the Chillagoe or Hodgkinson gold fields of Queensland. A little arsenopyrite and pyrite occur with depth. The quartz bodies are pipe-like in form and are most irregular, pinching and expanding suddenly. Molybdenite usually begins to appear 10 to 12 ft. below the surface. The oreshoots within these pipes are most erratic and at comparatively slight depths (300 to 400 ft.) apparently become impoverished, although there seems no reason why the mineralization should not extend to considerable depths.

The granite country rock near the pipes contains both molybdenite and quartz. Possibly these pipes were formed at the junction of two joints. In the vicinity of Bamford, Queensland, the granite surrounding the pipes is frequently altered to a greisen (quartz, muscovite, pyrite, molybdenite and wolframite), and that in immediate contact with the pipes is silicified to a molybdenite-quartz rock. The pipes in this part of the state usually pitch parallel to the roof of the granite batholith which is intrusive in porphyry. The filling is quartz, wolframite and molybdenite which latter may form 1% of the mass. Scheelite is not uncommonly associated. Iron pyrite, chalcopyrite, blende, galena, bismuth and fluorite occur in vugs and are younger than the filling mentioned. Granite is the usual country rock of the molybdenite-tungsten deposits, but at Scamander, Tasmania, the veins are in micaceous quartzite and the molybdenite occurs not only in the veins but in the country rock as well. A granite boss is near. Molybdenite and hübnerite are associated in the silver-copper-lead-zinc veins of the Potosi, Mont., district, and in the blende-galena veins of Blue Wing, Idaho. Molybdenite is an accessory of the ferberite veins of Boulder, Colorado.

Molybdenum may replace a considerable amount of tungsten in scheelite and, while molybdenite is associated with this tungsten mineral at numerous widely scattered places, I know of no such deposit which is of value.

Bismuth and molybdenite occur together in tungsten and tin deposits, and bismuth and molybdenite are associated in pegmatites at Cooper, Washington County, Maine, and those of the township of Villemontel, Que. At Kingsgate, N. S. W., molybdenite, bismuth and quartz are associated, gold and silver also being present. The country rock is granite intrusive into slate. The minerals occur in pipes from 6 to 25 ft. in diameter, which are twisted around their vertical axes. The masses of molybdenite in instances weigh over half a ton. At the Jingera mines near Wyndham, N. S. W., similar pipes contain feldspar and a little mica and garnet, in addition to quartz. The pipes are from 15 to 20 ft. in diameter.

At present the tungsten, tin and bismuth deposits are the source of considerable molybdenite and presumably will in the future be the source of a larger production (tin, New England district of New South Wales and Hozaribagh, India; tungsten, Hodgkinson, Queensland; bismuth, Kingsgate, N. S. W.). Any one of the metallic minerals may serve as a byproduct of the mining of the other. Often the coarseness of the molybdenite is advantageous to milling. On the other hand, the irregularity of the orebodies is not conducive to low mining costs.

Molybdenite is present in small amounts in cobalt veins which are dependent on the after effects of granitic intrusions, as at Tunaberg, Sweden, at Kakhetie, Caucasus, and Balmoral, Transvaal.

Occurs in Auriferous Veins and Is Commonly Associated with Copper

Molybdenite occurs, as before mentioned, in auriferous copper veins and in auriferous tungsten veins, and is also not unusual in auriferous pyrite veins and in auriferous telluride veins. These gold veins as a rule were formed at depth by hot magmatic waters derived from the cooling granitic masses (usually granite or monzonite and, less commonly, diorite). Many of them are of pre-Cambrian age. The molybdenite may antedate the quartz, or it may occur along slip planes in the same. Gold quartz veins are not believed to be an important future source of the molybdenite.

The occurrence of molybdenite in copper deposits is world-wide, and, with the exception of quartz, perhaps no other mineral is as commonly associated with it as chalcopyrite. Molybdenite, while by no means an

abundant constituent of the disseminated porphyry coppers, is present in most of them. It is also a common constituent of cupriferous quartz veins derived in most cases from magmatic waters given off by igneous rocks of the granite or monzonite families. The veins were formed at medium or great depths. These veins are linked by gradational types to the quartz-molybdenite veins, the auriferous veins and the tungsten ore deposits. They are to be found in practically every country in which mining is an important industry. In addition to molybdenite the more common sulphides are chalcopyrite, sphalerite and pyrite.

As a rule the molybdenite is present in these copper veins in too small quantities to be exploitable, and in addition the copper is difficult to separate. There are, however, exceptions, the chief molybdenite mines of Sweden on Ekholmen Island, in the Westerivik Archipelago, being of this type. The country rock, amphibole-gneiss and mica-schist, is cut by seven veins from 0.15 to 0.5 m. wide. At one place four join one another and form a quartz mass 1.5 m. thick. The vein matter consists of molybdenite, chalcopyrite, quartz and feldspar. The largest masses of molybdenite weigh 5 lb., and the ore is easily cleaned. Another exception is the property of the Leviathan Mines Co., situated in Copper Canyon, Mohave County, Ariz., on the eastern slope of the Hualpai Mountains. Frederick W. Horton says that two veins, one 6-40 ft., and the other 2-20 ft. wide, cut granite. They consist of quartz and considerable molybdenite and chalcopyrite, with a little pyrite and sphalerite. The ore contains from 2 to 3% molybdenite.

Molybdenite in Contact-Metamorphic Deposits

Molybdenite is a common, although usually not an abundant constituent of many cupriferous contact-metamorphic deposits. These deposits were formed by hot waters and gases given off by intrusive bodies of granite, monzonite, granodiorite or diorite. As a source of molybdenite, they are of little promise, as a clean separation of the copper would be almost impossible. Flotation may in instances, however, eliminate the difficulty.

Contact-metamorphic deposits containing no copper are more promising sources of the metal, but milling will not be easy. A common occurrence of molybdenite in Ontario and Quebec consists of an acid rock (granite, aplite or pegmatite) which may be molybdenite-bearing, and which is intrusive into limestone. As a result of the metamorphism, next to the intrusive vein-like masses of pyroxene there are calcite, quartz, molybdenite, mica, pyrite and pyrrhotite, etc. At Haliburton, Ont., molybdenite, pyrrhotite and chalcopyrite form veins in a contact metamorphic limestone.

Schrader and Hill[8] state that the Leader mine, near Helvetia, Ariz., is in Paleozoic limestone intruded by post-Carboniferous aplite and granite-phorphyry. The molybdenite occurs in lenses, irregular bodies, or in masses and crystal aggregates embedded in both silicified garnetiferous limestone and in quartz masses in it. In the quartz, pyrite and chalcopyrite are associated with molybdenite. The molybdenite is in part contemporaneous with quartz and in part younger than it, both being dependent in origin on the granite-porphyry intrusion. The molybdenite is mostly fine-grained, but in places it is found in crystals ranging up to ½ in. and more in diameter. Waterhouse describes a scheelite-bearing, garnetized limestone containing molybdenite, on Kings Island, near Tasmania, which may be of commercial importance. The molybdenite not only is a constituent of the contact-metamorphic rock, but occurs in quartz veinlets cutting it and also is a constituent of an intrusive aplite near by. Bismuth and pyrite are also associated, and assays show the presence of tin. Molybdenite is an accessory mineral in the scheelite contact-metamorphic deposit of Bishop, Calif., and in Carpenter Gulch, Powell County, Mont., it occurs in metamorphic limestone.

Molybdenite Associated with Iron and Lead

The Foley pyrite deposit[9] in Lanark County, Eastern Ontario, occurs in a small body of pre-Cambrian marble inclosed in granite. Pyrite and pyrrhotite are equally abundant, and with them occur pyroxene, calcite, mica and molybdenite. This is probably a replacement deposit formed at high temperature and considerable depth. Merrill reports molybdenite as disseminated scales and small bunches in iron ore of the Hude mine, at Stanhope, N. J., sometimes making up 2% of the ore. It is also reported from the Ogden mine, in Sussex County, New Jersey.

Molybdenite or some other primary form of molybdenum must be comparatively common in lead deposits, judging from the frequent occurrence of wulfenite as a secondary mineral in the oxidized zone of these orebodies. In the Cottonwood, Utah, district, molybdenite is common at depth, accounting for the wulfenite in the outcrops. Molybdenite also occurs in the lead deposits of Sarrabus, Sardinia; Nertschinsk, Siberia; Dusquesne and Covado, Wash., and Grout Lake, B. C.; all were deposited by granitic magmatic waters. Molybdenite is a sparse constituent of a number of the comparatively shallow precious-metal orebodies formed by Tertiary igneous rocks, particularly those containing tellurium.

Small Amounts in Sedimentary and Basic Igneous Rocks

While not characteristic of sedimentary rocks, Hillebrand found traces of molybdenum in a limestone from northwestern Mexico, Stutzer reports it from coal, and it is present in traces in the Mansfeld copper deposit, which many authorities consider of sedimentary origin. At Impendhle, South Africa, a horizontal bed of pyritiferous sandstone is said to contain 5% of molybdenite. The bed is from 3 to 4 ft. thick. The presence of molybdenum in mine waters in Idaho Springs, Colo., has already been mentioned, and Fleck reports it from the alkali waters of Soda Lake, San Bernardino County, California.

While typically an associate of siliceous igneous rocks, molybdenum occurs, in small amounts at least, in basic igneous rocks. Thus it has been detected in two basic lavas from the Hawaiian Islands. Powellite, a calcium molybdate containing tungsten, is one of the rare con-

[8]United States Geological Survey, Bulletin 430, pp. 156-7, 1909.

[9]P. E. Houkins, Bulletin, American Institute of Mining Engineers, August, 1916, p. 1369.

stituents of the Lake Superior copper deposits, and traces of molybdenite are reported in the Worthington mine of the Sudbury district. Molybdenite is mentioned by Diller as one of the later constituents of the Klamath Mountains, Oregon, gold mines, which he apparently considers dependent on the intrusion of a peridotite. It will be remembered that Bastin and Hill believe that the tungsten ores of Boulder County, Colo., which contain molybdenite, are dependent upon the intrusion of gabbros and iron-ore rocks, differentiates of a monzonitic magma. It is not to be expected, however, that commercial bodies of ore will be associated with igneous rocks.

Iron and Steel Production of the World

The production of pig iron in the world in 1916 showed a considerable increase notwithstanding—perhaps it would be more correct to say in consequence of—the continuance of war conditions. It has been difficult to get even approximate figures for some countries, and exact returns are impossible for others. For instance, it is known that a number of furnaces are in blast in Belgium and in the northern part of France under German occupation, but no exact figures for their make of iron are obtainable. The publication of monthly statements of production in Germany itself has been suspended since last October, although there had been no previous break in their issue since the war began. With these limitations and by careful comparison of all available information, we find that the pig-iron production of the world in 1916 reached a total of 78,286,630 metric tons, showing an increase of 12,407,985 tons, or 18.4%, over the preceding year. Over 70% of this gain was due to the large production of the United States. Great Britain and Germany both made considerable gains.

The blast furnaces of the United States furnished 51.2% of the world's make of pig iron in 1916, against 46.1% in 1915; while the total make by the three chief producers—the United States, Germany and Great Britain—increased from 77.6% in 1915 to 81% in 1916. The United States output in 1916 was thus a little over one-half of the world's total, and promises to continue at that level while present conditions last.

The figures indicate that there has been little or no difficulty about supplies of iron ore. British imports from Sweden have been rather difficult, but those from Spain were heavy throughout the year, and home production was large. Germany was able to retain control of the Minette ore deposits of Lorraine and Luxemburg, as well as most of the Belgian mines, and, it is understood, also obtained considerable quantities from Sweden. France suffered from a lack of raw material, as did Russia from the suspension of the mines in Poland.

Table I gives the production of pig iron for two years, the figures for the United States and Great Britain being reduced to metric tons for purposes of comparison. In Table II is given the production of steel for two years, also in metric tons. This table is compiled under the same conditions and limitations as that of pig-iron production.

The total production of steel as shown in the table was 86,843,651 metric tons in 1916, being 16,268,876 tons, or 23%, more than in 1915. For the second time the make of steel largely exceeded that of pig iron, the excess being 4,695,130 tons in 1915 and 7,284,057 tons last year. This was due to the nature of the demand for material and especially for war munitions where steel is needed; and to the widely extended employment of the open-hearth process, permitting the use of large quantities of steel scrap. Probably a higher proportion of scrap found its way into the furnaces in 1916 than ever before. Of the increase in the total production of steel last year, 10,792,505 tons, or 66.4%, was due to the great output of the United States. Our country furnished 50% and the three chief producers 79.3% of the whole production last year. Some of the minor countries showed considerable gains, notably Austria-Hungary. The German production was kept up well, partly by the extensive use of scrap and partly, without doubt, by the use of pig iron made in Belgium and in the occupied districts of France.

As in the previous year, a very large part of the steel output was absorbed in the manufacture of shells, guns and other munitions of war. There was also a good demand for material for new construction, and in the United States in the latter part of the year a great demand developed for plates and shapes for shipbuilding. This has continued during the current year. The future demand and production depends to a large extent on the course of the war; but there is little doubt that the world will absorb the largest make of iron and steel which is possible for some time to come.

TABLE I. PIG-IRON PRODUCTION OF THE WORLD
(In Metric Tons)

	1915	1916
United States	30,394,872	40,063,714
Germany	11,790,199	13,190,172
Great Britain	8,934,348	9,191,836
Three chief producers	51,119,419	62,445,722
Canada	838,626	1,086,659
Austria Hungary	1,960,000	2,005,000
France	4,750,000	5,250,000
Belgium	550,000	1,050,000
Italy	395,000	386,249
Russia	4,600,000	4,350,000
Spain	419,000	448,000
Sweden	767,600	760,000
Other countries	480,000	505,000
Totals	65,879,645	78,286,630

TABLE II. STEEL PRODUCTION OF THE WORLD
(In Metric Tons)

	1915	1916
United States	32,665,453	43,457,958
Germany	13,237,696	16,050,000
Great Britain	8,484,559	9,391,963
Three chief producers	54,387,708	68,899,921
Canada	927,359	1,307,883
Austria-Hungary	2,686,626	3,336,607
France	4,875,000	5,225,000
Belgium	405,000	750,000
Italy	965,000	1,009,240
Russia	4,900,000	4,850,000
Spain	398,000	425,000
Sweden	580,000	570,000
Other countries	450,000	470,000
Totals	70,574,775	86,843,651

Broken Hill Proprietary Co., of Melbourne, Australia, shows the production of ore from the company's mines for the second half of 1916 to have been 110,276 tons, 97,630 tons of which were milled, producing 17,065 tons of 58.733% lead concentrates carrying 28.12 oz. Ag per ton. The zinc flotation plant treated 13,232 tons of tailings, producing 2805 tons of concentrates containing 58.73% Zn and 5.72% Pb per ton. No dividends were declared, although net profits of £159,429 were earned. A large addition to the company's steel plant at Newcastle is under construction.

Prospecting with Electricity

BY H. R. CONKLIN
Mining and Electrical Engineer

The basic problem to the mining industry is the finding of ore in paying quantities. This difficulty has produced many operators of the divining rod, and several other methods have been tried in the effort to determine the hidden ore conditions underground and avoid the expense of drilling or of sinking shafts in barren ground. The whole subject is of great interest, and the possibilities are so vast that no one need be surprised at the large number of divining-rod operators or their varied methods of working. I have known some remarkable facts about divining rods, but the final results in every case have had no probability of development to a condition of certainty that would warrant a business investment, and almost every operator of a divining rod is afflicted with an over-developed imagination.

In an effort to reach the desired result of being able to determine the position of an orebody under the surface of the ground, the idea of exploring the ground magnetically was conceived, and during the last three years has been developed, first by laboratory work to establish a suitable method, and later by field work to apply the laboratory method to actual working conditions. Patents are pending for this method, which will be of interest in many fields of prospecting work.

If a high-frequency oscillating electric current, such as is used in wireless telegraphy, be confined to a closed circular circuit, a high-frequency oscillating magnetic field is induced within this circuit, and the arrangement becomes a solenoid of practically no length and of large diameter. Any electrical conductor that may be included in this induced magnetic field will have an oscillating current induced within it, and this induced current in turn induces a high-frequency oscillating magnetic field, which reacts on the original magnetic field, reducing its intensity.

The necessary conditions are that the ore or ores sought for shall be conductors of electricity, for the method described enables the location of an electrical conductor, and the fact that certain ores are such conductors makes their location possible. An ore that is not electrically conductive cannot be determined by this method. Native metals, most sulphides and chlorides, but very few carbonates, silicates or oxides are such conductors.

The progress of laboratory experiments was slow and tedious, and the difficulty of adapting these experiments to field work and designing the necessary instruments was even greater. The final satisfactory results are shown by reference to Fig. 1, in which 1 is an alternating-current generator or other source of alternating current, supplying the low-tension coil 4 of a transformer, through a regulating, inductive resistance 5. The high-tension transformer coil 8 is connected to a suitable spark gap *s* in parallel with condensers 9 and 10 and the primary coil 11.

The primary coil 11 is laid in a circle on the surface of the ground, and within it is produced the oscillating magnetic field. This magnetic field decreases toward the center of the primary coil and might be plotted as shown in Fig. 2, in which the ordinates represent change in magnetic flux. Owing to unavoidable variations in the original source of power, these ordinates may vary during observations to an extent greater than their diminution due to the neighborhood of an electrical conductor, so that the measurement of this magnetic field requires a balanced method.

For measuring this magnetic field, two identical exploring coils 12 and 13 (Fig. 1), of suitable diameter and number of turns, are connected in series with two current rectifiers 16 and a sensitive galvanometer 17. By placing one of these exploring coils at a measured distance from the center of the primary coil and moving the other around the center, the induced currents in the exploring coils being opposed to each other, a line, along which the magnetic flux is equal, is established and may be plotted. The location of the movable exploring coil, when the galvanometer reading is a minimum, determines this line, which may be called an isogonic line and is similar to a contour line on a topographic map. In the latter comparison the completed plot of these lines suggests contour lines defining a depression, as shown in cross-section in Fig. 2. Now if the magnetic flux be decreased as at *A* in Fig. 2, due to the presence of a conductor of electricity, the contour lines are drawn out in the direction of the conductor, and the plotted curves are distorted from the normal circular form, enabling the location of the conductor to be determined.

Several sets of actual distorted contour lines, as determined in the field, are shown in Figs. 3 and 4. All were observed with the primary coil 200 ft. in diameter. One of these plots, in Fig. 4, shows the location of a 2-in. iron pipe line buried about a foot underground, and is also distorted by a body of conductor still deeper.

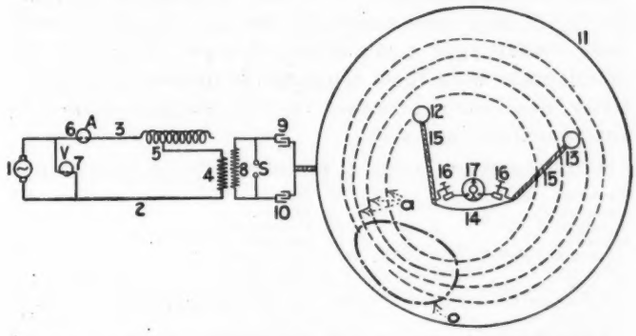


FIG. 1. ARRANGEMENT OF PROSPECTING APPARATUS

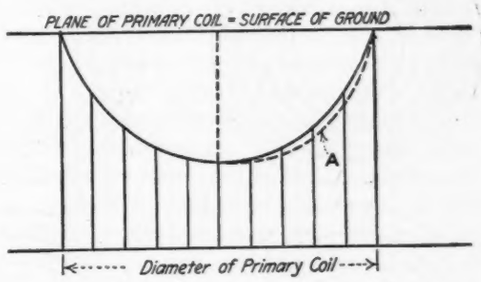


FIG. 2. PLOT OF THE MAGNETIC FIELD

The primary coil is shifted and these contour lines plotted for a sufficient number of centers to determine the general size and dimensions of the body of conductor, after which prospect drilling is done to prove the depth, thickness and quality of the conducting orebody. If the conducting orebody be below and nearly symmetrical about the center of the primary coil, the magnetic field will be weakened, but the contour lines are not distorted from their normal circular form. However, with a sufficient number of sets of contours, the presence of the conducting orebody is positively determined.

If the conductor be close to the surface, or nearly in the plane of the primary coil, the galvanometer shows a minimum reading when the same amount of magnetic flux is inclosed by both exploring coils, but this minimum reading is not zero, since some current will flow between the exploring coils, probably due to a difference in phase caused by the angle between the lines of force in the two magnetic fields.

The presence of water courses, puddles on the surface or solutions in the ground does not affect this method,

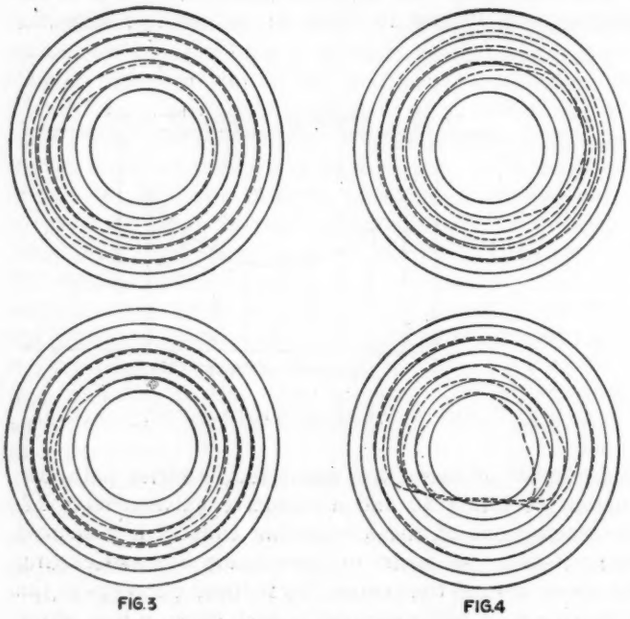


FIG. 3 FIG. 4

ACTUAL DISTORTED CONTOUR LINES IN THE FIELD

since liquids are not appreciably conductive of the low-voltage oscillating current that is induced. Contour lines about any given center can be practically duplicated at any time, regardless of the weather conditions or variations in ground water.

Theoretically, the presence of a conductor within a distance from the plane of the primary coil, of two-thirds the diameter of the primary coil, will measurably affect the magnetic flux in the plane of the coil. This has been proved practically, so that if the primary coil is 200 ft. in diameter, a conductor within 130 ft. of the surface or, if the primary coil is 400 ft. in diameter, a conductor within 260 ft. of the surface, will cause distortion of the contour lines.

The field development of this method was carried out in the Joplin district, Missouri. Of the ores found in this district—namely, zinc blende, galena and pyrite—the zinc blende is not a conductor and cannot be determined, but the galena and pyrite may be determined satisfactorily. Both galena and pyrite are conductors, and as this electrical method does not distinguish the quality of the conductor, drilling is necessary after determining the orebody electrically for identifying the mineral by drill cuttings. This disadvantage is somewhat offset by the fact that all three minerals are often closely associated, so that the electrical determination of an orebody which consists of either galena or pyrite may incidentally, by drilling, develop an orebody of blende.

In order to operate with efficiency, an automobile truck has been equipped with self-exciting alternating-current generator, driven by a gasoline engine, and all instruments and machinery required for producing the high-frequency oscillating magnetic field are mounted in the truck body. An instrument box containing galvanometer, current rectifiers and switches is provided for convenience and portability when exploring the magnetic field to determine the contour lines. Portable reels carry the necessary wires. The entire equipment may be placed in the truck for moving, making a complete outfit which is very similar to the automobile wireless plants that are used in the army.

For prospecting in any mineralized district, the first requirement is the tabulation of all ores liable to be found in that district, with their degrees of conductivity. I have been unable to find any record of work done toward such a tabulation of ores. A partial list of minerals, with their comparative degrees of conductivity, has been determined for this work, as shown in the accompanying table.

COMPARATIVE ELECTRICAL CONDUCTIVITY OF MINERALS

Proustite	18	Zinkite	115
Cerargyrite	0	Blende	0
Pyrargyrite	20	Hydrozincite	0
Bromirite	0	Calamine	0
Chalcocite	115	Smithsonite	0
Chalcopyrite	115	Willemite	0
Enargite	110	Magnetite	120
Tetrahedrite	110	Specular Hematite	50
Malachite	0	Pyrite	110
Chrysocolla	0	Red Hematite	0
Cuprite	0	Limonite	0
Tenorite	0	Pyrolusite	115
Azurite	0	Psilomelane	0
Atacamite	0	Manganite	0
Galena	105	Braunite	0
Jamesonite	40	Hausmanite	0
Boulangerite	90	Rhodonite	0

The main difficulties, in the district where the method was developed, are the frequent occurrence of pyrite, which is of no value, and the nonconductivity of zinc blende, which is the most desirable ore. The Joplin district, however, has proved a most advantageous place for the development of this method, since the orebodies are generally less than 200 ft. below the surface, and facilities for experimental work are ample and convenient. Field experiments have been carried on for over a year. Of eleven locations tested by drilling, after the electrical observations had indicated a conductor, seven proved the presence of the conductor, six cases being pyrite and one case galena. The four locations not proved by drilling occurred in the early part of the work, before enough data had been accumulated to assure proper interpretation of the contour lines.

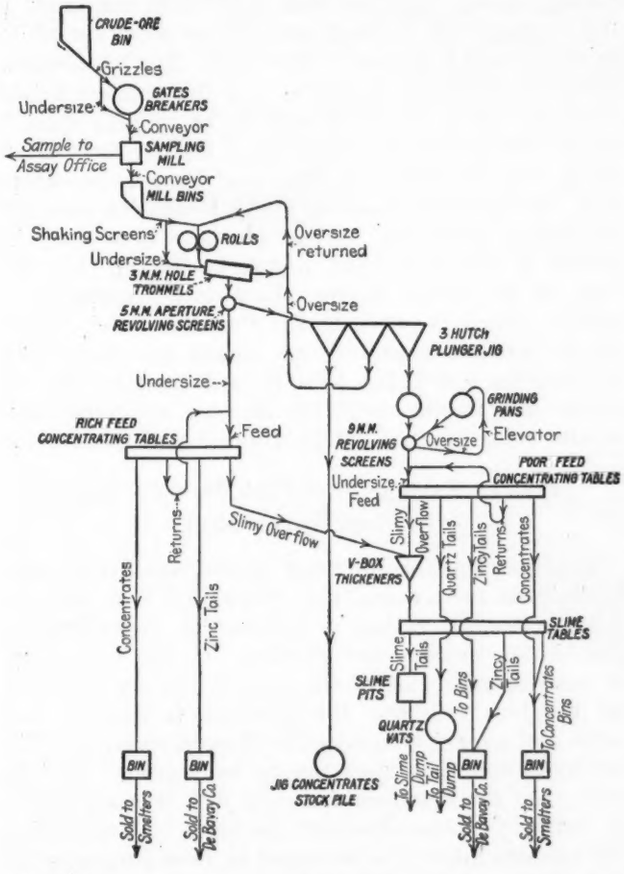
A new type of agitator for liquids has been developed at the Johns Hopkins University, suitable for producing very minute subdivisions of liquids containing finely divided solids, and has been applied to cleaning used lubricating oils. By the use of the agitator, finely divided carbon or other solid matter can be easily and cheaply separated out.

Broken Hill South Mill

The mine of the Broken Hill South Silver Mining Co., of Broken Hill, N. S. W., Australia, has a weekly capacity of 8000 tons. The zinky tailings are re-treated at a separate plant. Operations are in charge of W. E. Wainwright, general manager, J. C. Cunningham, engineer, and W. J. McBride, metallurgist.

The headframe at the main shaft is 60 ft. above the ground level, in order to permit of the gravitation of the ore into the crude-ore bins, through the Gates breakers, into the crushed-ore bins and upon a combined horizontal and inclined conveyor for reëlevation to the mill bins. The mill is adjacent to the main shaft, and the general operation of the crushing and concentrating mill is set out as shown in the flow sheet.

The ore is raised in cages that will hold two mine cars having a carrying capacity of 24 cwt. The cars are run by trammers from the headframe to rotary tip-



FLOW SHEET, BROKEN HILL SOUTH, N. S. W., AUSTRALIA

ples of the gravity side-tip type, which deliver into the crude-ore bins. The ore is fed through 4-ft. openings on the face of these bins, and in gravitating toward the opening passes over a grizzly set in the back of the bins. The ore is crushed in three No. 5 Gates crushers and one 30 x 18-in. Hadfield jawbreaker; all these breakers crush to 1½- to 2-in. gage, the larger breaker being used for breaking lumps of ore that are too large for the Gates crushers. A chain strung across the opening of the crude-ore bin restrains the gravitation of the ore from the bin to Gates breaker hoppers. The crushed ore drops from the crushers into the bins directly underneath, and each of these bins feeds to a combined horizontal and inclined conveyor, which raises the ore to a sampling plant in which a 1/100 part of the total ore is cut out for sampling purposes. After the sample cut has been taken, the ore is passed to another belt, which raises the ore to the level of the four mill bins, and by means of a traveling tripper discharges into any one of these. The ore is fed by feed rollers from these bins on to inclined shaking screens. These screens have perforated plates set in the bottom so that the water that is applied to the head of the shaker removes all material less than 4 mm. and passes the balance to the crushing rolls, which are the flanged and plain type, 36 in. in diameter by 18 in. face. These are driven through gearing at 17 r.p.m. and in accordance with the practice of the last 20 years, the tension between the crushing rolls is maintained by large rubber buffers 15 in. in diameter and 1¼ in. thick, 32 of these being distributed over the four tension bolts used in this design of rolls. The rolls deliver to trommels immediately underneath, all material under 4 mm. being passed to the jigs, the oversize returned to the rolls. There is one duplex plunger jig to each of the four sections of the mill. Each jig has 4 mm. screens and three hutches on each of the duplex sides. The first hutch yields concentrates, the second hutch returns the water and material to the rolls, and the third hutch, which is without screens or plungers, discharges to 5-ft. grinding pans. The product from the grinding pans is reëlevated and passed over revolving screens covered with 16-mesh screen, of 25-gage wire, the undersize is passed to one section of concentrating tables, and the oversize is returned to the grinding pans. The undersize from the roll trommels, before being fed to the jigs, is passed over revolving screens having 30-mesh screen of 28-gage wire, in order to eliminate the very fine material from the jig feed. This fine material is fed upon a special section of concentrating tables, and the return, or middlings product produced from this, together with a similar product produced from the grinding-pan undersize, is returned to other tables for re-treatment. The slimes from the feed end of all concentrating tables is thickened and fed to similar tables for separate treatment. The final products from all these table treatments are concentrates, zinky tailings, quartz tailings and slime tailings. All concentrates, zinky tailings and quartz tailings are elevated and fed into bins or vats which are fitted with filter bottoms. These products, when drained sufficiently, are loaded direct through chutes to the railway cars, all concentrates being shipped to the smelteries, and zinky tailings to the flotation mill of the Amalgamated Zinc, Ltd., while the quartz tailings are returned underground and used with other similar material for filling. Slime tailings are thickened in pits, which, when full, are discharged, elevated and laundered upon a slime dump, from which they will be drawn for re-treatment in the future.

Although no ore sorting is done at the present time, it is contemplated for the future; it may be of interest to know that the average percentage of slime produced is, by weight, 15%, having an approximate assay value of 11% Pb, 7 oz. Ag and 13% Zn per ton. The crude ore average assay is 15% Pb, 7 oz. Ag and 14% Zn.

The concentrating tables in operation are special Wilfleys and are fitted with wooden decks having rows of grooves running parallel to the length of the table.

Tonopah Belmont's Expansion

In line with the policy of expansion of a number of successful mining companies, the Tonopah Belmont Development Co. has been acquiring additional properties during the last few years, not only in the Tonopah district where its original mine is situated, but wherever good properties could be found. From the company's fourteenth annual report, for the year 1916, the following data are taken regarding the newer properties that have been purchased or secured under various option agreements.

In the Tonopah section proper the company has optioned an area extending easterly about 9000 ft. from the Halifax and Mizpah Extension mine, which adjoins the Tonopah Belmont mine on the east. The ore-bearing rocks (trachytes, etc.) do not come to the surface in this territory, but it is regarded as possible that they will be found underneath the cap rock. Diamond-drill prospecting of the area at depth has been started. Four holes are being drilled, but up to the date of the issuing of the report the cap rock had not been entirely passed through.

The Emma mine, at Dunton, Dolores County, Colo., was optioned early in 1916, when development work was undertaken to determine the tonnage and grade of ore that may be found below the old No. 5 tunnel level. The mine in the past was developed through a series of tunnels, and the lowest, the No. 5, was situated on the bank of a small river, a few feet above the water, so that deeper development was possible only through a shaft. The No. 5 tunnel was 3285 ft. long and showed five oreshoots having a combined length of 1240 ft. On the new sixth level, 160 ft. below the No. 5 tunnel, drifts have been pushed out north and south, but the development at the date of the report had not proved or disproved the mine, and the work is to be continued under a modified agreement.

In California the company acquired in February, 1917, the Eagle-Shawmut mine, on the Mother Lode at Shawmut, in Tuolumne County. This property has a record of production of about $4,500,000 in gold and was worked to a depth of 2300 ft. The mining plant and the 100-stamp concentration mill and chlorination plant will be utilized with some improvements. The future of the operation is in the downward extension of the main oreshoot. On the 16th, or lowest, level the shoot consists of a series of closely joined or overlapping lenses of sulphide ore, with a length on the vein of about 490 ft. and an average horizontal width of about 10 ft. The average value per ton is about $7.50. An operation of 400 tons per day is planned if the oreshoot continues to sufficient depth. At present the ore reserve of positive and probable ore is about 159,000 tons. The mill, which will be remodeled, will not be started until further development work has been done.

Surf Inlet Mine Now the Most Important New Property

The Surf Inlet mine, on Princess Royal Island, British Columbia, is at present the most important of the Tonopah Belmont new properties, and production at this gold property is expected to be initiated during the present summer. The "available and probably indicated ore reserves" are given as 385,320 tons, having an average value of $11.22 per ton in gold. During the last year 2595 ft. of development has been done under ground, consisting of drifts, crosscuts, raises and winzes. No special effort is being made during the current year to increase the ore reserves, but this feature will not be lost sight of in the future.

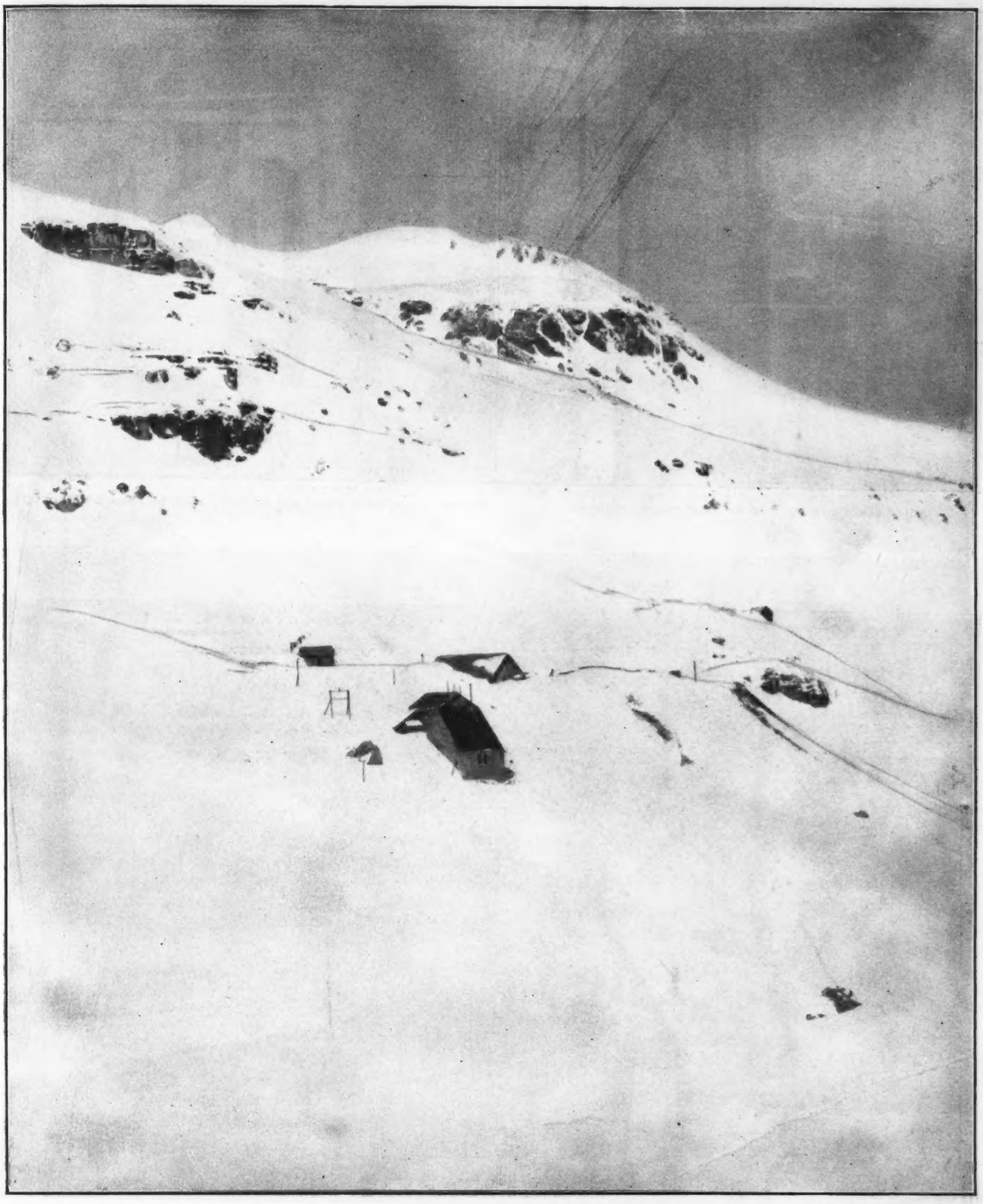
The company has been engaged lately in the installation of a mining and milling plant and the hydroelectric power plant and transportation systems, the mine being 7½ miles from the coast. At the hydroelectric plant two turbine units, of the single-spiral volute cast-iron case, horizontal single-runner, double-discharge, Pelton-Francis type, built by the Pelton Water Wheel Co., of Harrisburg, Penn., have been installed. Each turbine is direct-connected to a 468 kv.-a. (375 kw. at 0.80 power factor) three-phase 60-cycle 440-volt generator running at 600 r.p.m. The power-transmission line from the station to the mine plant is about 5.65 miles long. An Ambursen hollow reinforced-concrete dam has been built, with the crest of the spillway 288 ft. long, and at an elevation of 73 ft. above main high tide in Surf Inlet. The total length, including abutment, is 420 ft., and the greatest height from the bottom of cut-off wall to the spillway crest is 64 ft. The dam raises the level of Cougar Lake about 40 ft. and the levels of Bear and Deer Lakes about 6 ft. A variety of transport systems has been arranged to connect with the various plants. Cars may be loaded at the Surf Inlet wharf, hauled up over the dam on an incline engine plane, and dropped on a lighter, which is towed to the Paradise Creek wharf, where the 3-ft. gage railroad follows the south bank of Paradise Creek for 3500 ft. and then crosses the creek on a trestle about 500 ft. long and terminates at the mine yards, 5100 ft. from the starting point.

Copper as Well as Gold Will Be Recovered at the Surf Inlet Mine

The first concentrator unit at the Surf Inlet mine is designed for a capacity of 250 to 300 tons per day. After extended testing a combination concentration-cyanidation process was adopted. In the first stage, or concentration part of the process, the ore is broken by gyratory crushers, the grinding is done in ball mills, and a rough concentration is made on tables. The tailings from the tables are to be reground in tube mills, and the resultant fine pulp will be concentrated by flotation in Jones-Belmont machines. About half of the valuable mineral is recovered by table concentration and the remainder by flotation. The tests have indicated that about 94% of the total gold and 96% of the total copper will be recovered in the combined concentrates. Bullion is to be the ultimate product on the ground.

Another mine, the so-called Pugsley mine, the property of the Princess Royal Gold Mines, Ltd., comprising three claims immediately south of the Surf Inlet mine, was optioned in April, 1916, for two years. Several veins had been under development, and up to March, 1917, drifting and crosscutting amounting to 170 ft. had been done by the Tonopah Belmont company. If sufficient tonnage is developed, the railroad will be extended so as to bring the Pugsley ore to the Surf Inlet mill.

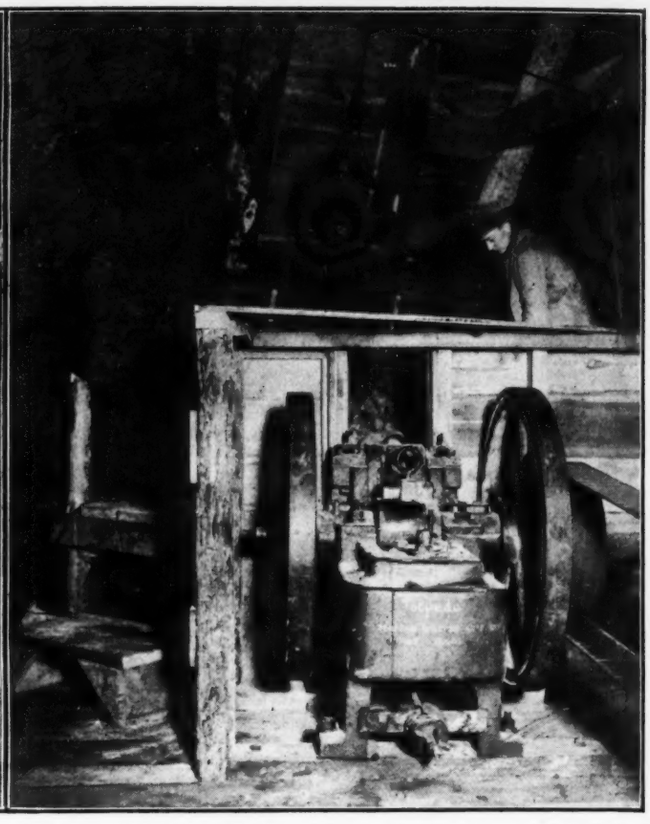
Colorado's Underground Milling Plant



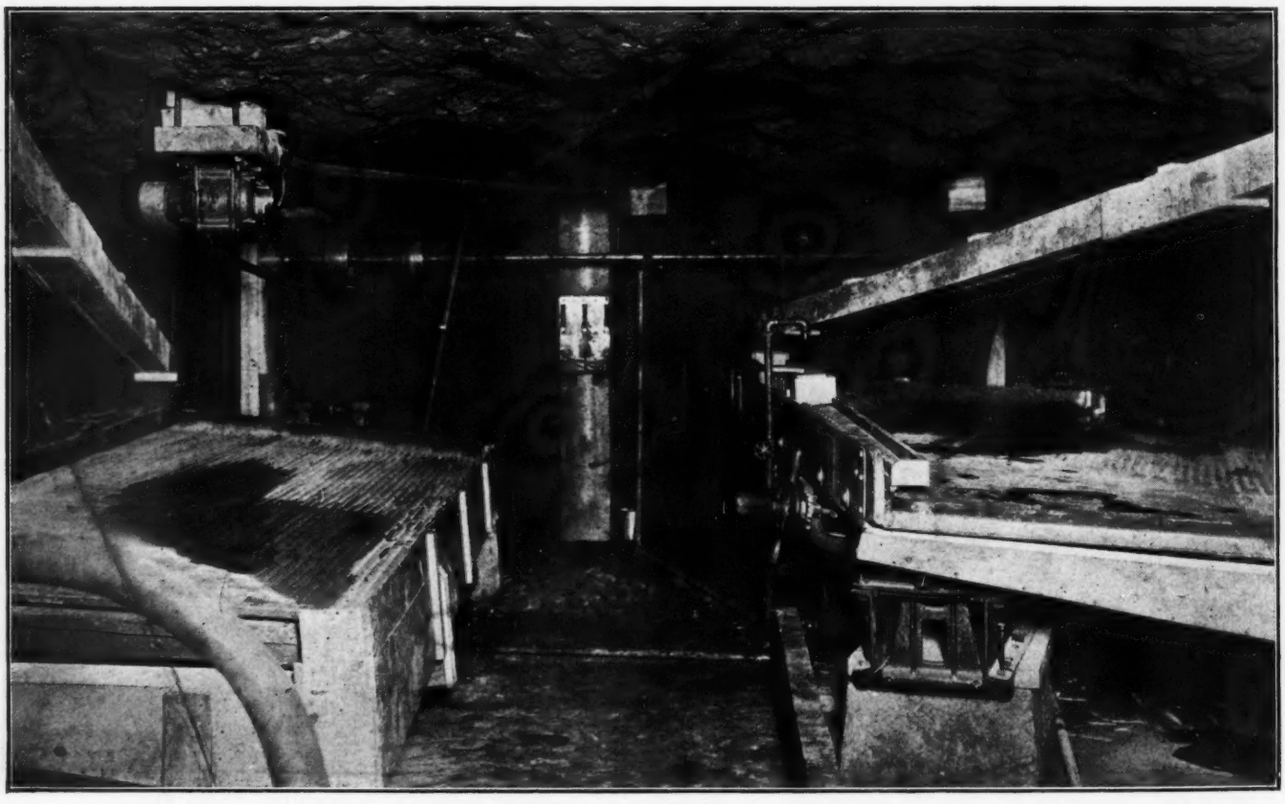
MOUNTAIN TOP MINE BUILDINGS AT PORTAL OF SUNRISE TUNNEL; ALTITUDE, 12,000 FEET

The mill for this mine was installed in chambers excavated out of solid rock in hillside, thereby making operations secure from the menace of snowslides

Automatic dumping skip at main tunnel, capacity 42 cu.ft.

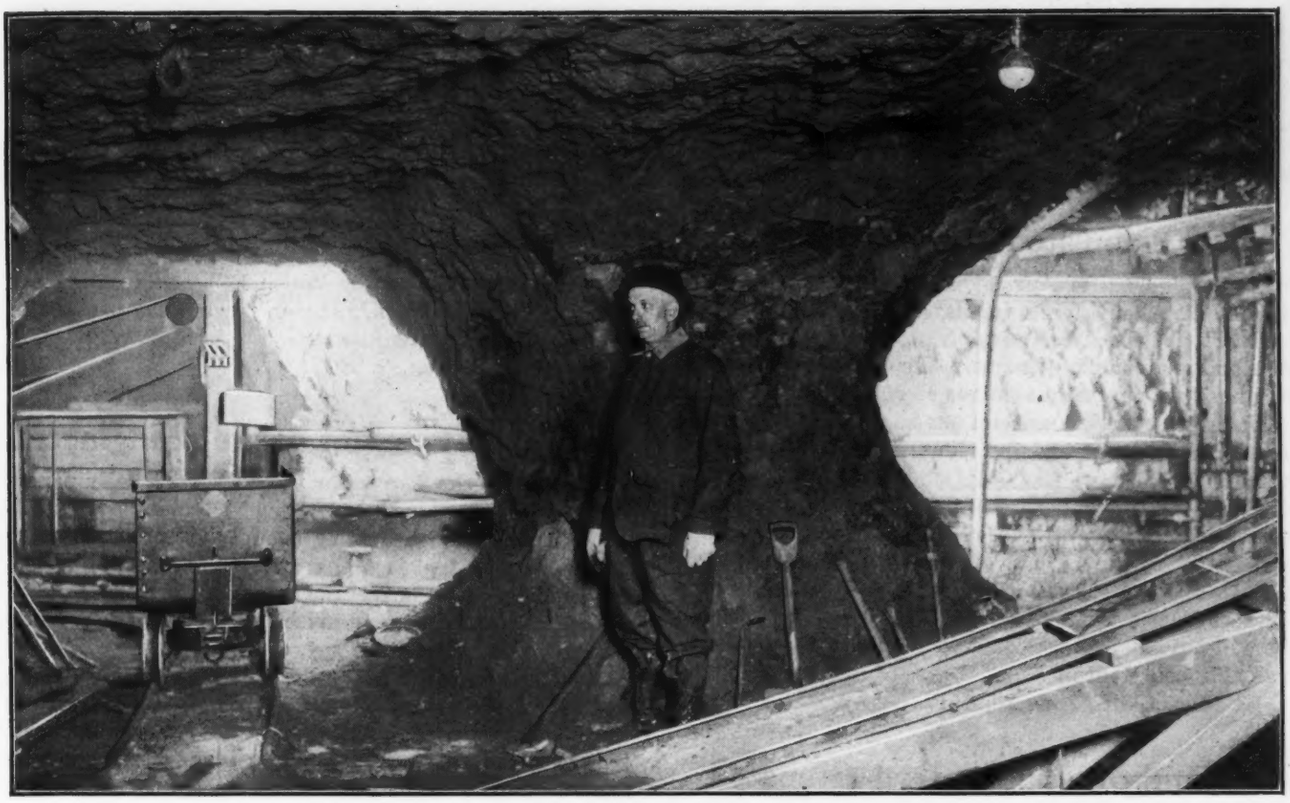


Crusher room with chute cut in solid rock at head of Mountain Top mill

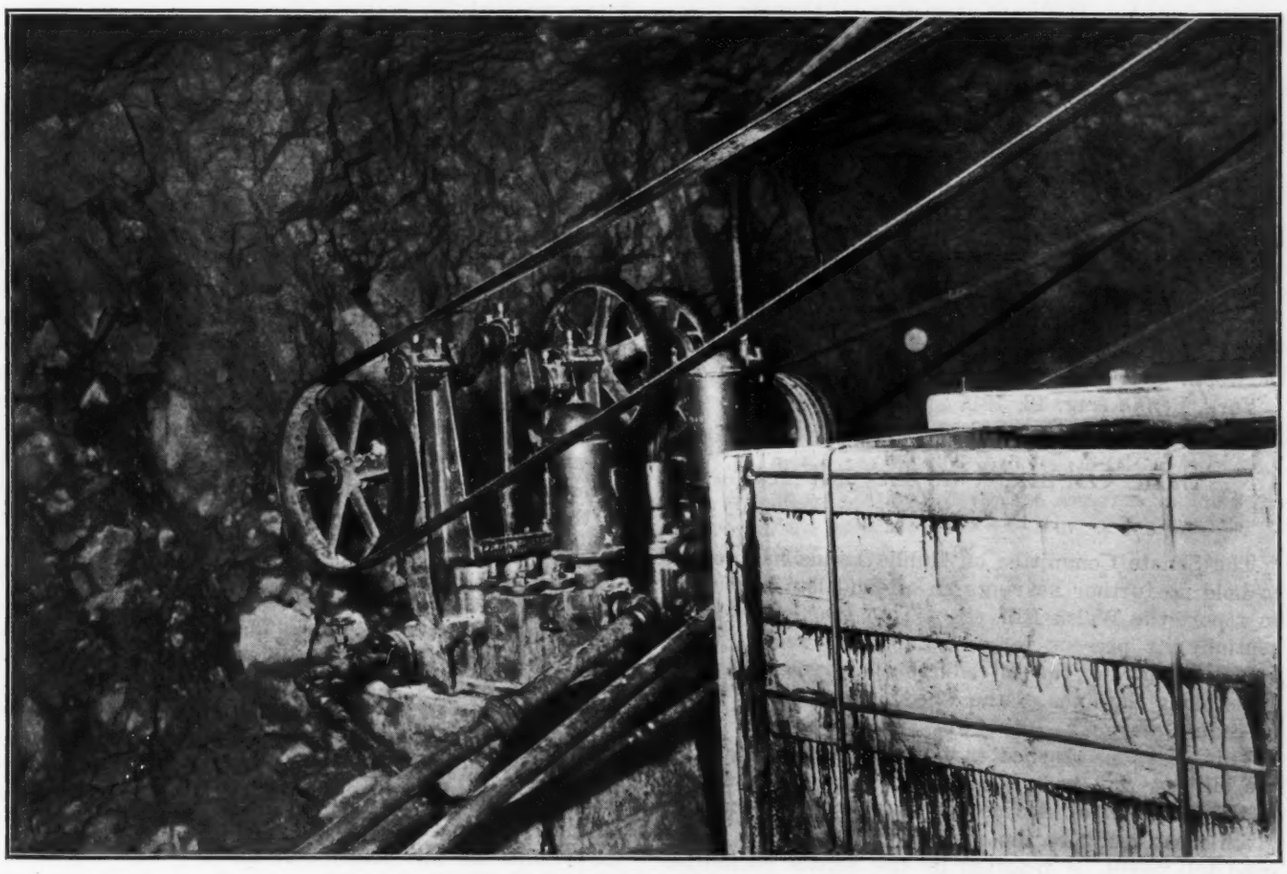


The lower table room with two froth-cleaning tables

VIEWS OF MOUNTAIN TOP MILL, SHOWING VARIOUS OPERATIONS CONDUCTED



The lower room of the mill, looking toward the main tunnel



Supply pump for sump—Mountain Top mill

IN UNDERGROUND CHAMBERS WITH COMFORT AND SAFETY

Correspondence and Discussion

Tabulated Air-Lift Data

In the *Journal* of Apr. 14, 1917, there was an article by A. W. Allen giving tabulated air-lift data. There seems to be one item missing that is needed to make this full and complete; namely, the cubic feet of free air required to elevate one gallon of solution.

From time to time articles have appeared giving these data, but on large and individual installations, such as "Water Problem at the Old Dominion Mine," by P. G. Beckett, in the bulletin of the A.I.M.E., Sept., 1916, where we find roughly that one cubic foot of air was required to elevate 1½ gal. of water, submergence being 179 ft. and lift 198 ft., with air pressure at 80 to 90 lb. The efficiency was 36%. Will you ask Mr. Allen if he will not supply these data for addition to his already valuable con'ribution? DOUGLAS MUIR.

La Jolla, Calif., June 26, 1917.

Mining Engineers Overestimated

I had always thought that, owing to his experience, the average mining engineer was particularly well fitted to grasp the essential features of a problem of administration. It always seemed to me that the President could do no better than to choose all his assistants from among members of the A. I. M. E. or from the list in the back of the *Journal*.

However, after attending a certain meeting of fifty mining engineers recently and hearing them gravely discuss for half an hour a question of internal finance involving a total of not to exceed $7.39, I have decided that I was wrong. Not a single protest from anyone! Not a single suggestion leading to the lynching of the treasurer! If the time of the other members is half as valuable as mine, the time lost by the fifty who gravely discussed this financial problem would be worth $5000. HENRY B. WORKS.

York, Penn., Aug. 13, 1917

Sane Oil and Gas Legislation a Necessity

The Senate Committee on Public Lands has decided to hold no further hearings on oil-land legislation, but to report the Walsh Bill (S. 45) to the Senate in essentially its present form so far as it relates to oil lands, except for the introduction of remedial provisions along the lines of the Phelan amendments of the preceding session.

This decision, reached in the face of the fact that the bill does not accord with the ideas of those, both in the Government service and outside of it, who have given most study to the matter, ends all hope that a good bill might be reported by the Senate committee. The one remaining hope that a good law may be enacted at this session lies in amendment of the bill on the floor of the Senate. Only the voice of the public, raised in protest against the tremendous waste of oil and gas that the enactment of the Walsh Bill would entail, can bring about such amendment or prevent the passage of the bill in its present form. MAX W. BALL.

Washington, Aug. 9, 1917.

Reflected Glory of Mining Engineers

Every time the *Journal* or the New York daily papers publish anything about Mr. Hoover I feel a glow of self-satisfaction—or perhaps it should be called reflected glory—due to the fact that we are both mining engineers. I think you feel the same way.

I was lately expressing myself in this vein to my better half, who, I regret to say, did not enthuse. Her repeated demands for a list of other mining engineers who had ever been prominent as anything else brought out the fact that I was able to refer to only one other, who, besides being the most prominent gold, silver and diamond miner of the period, was also the most prominent and successful in government and diplomatic circles.

In view of this and in order to provide a better foundation for my admiration for mining engineers in general, I suggest that the *Journal* run an occasional paragraph on "Cleopatra." MARK R. LAMB.

New York, Aug. 6, 1917.

A Florida Rare-Mineral Deposit

The article by Donald M. Liddell, in the *Journal* of July 28, calls attention to some results of a mineralogical study of the Florida sands which I had communicated some time ago in a private way to Buckman & Pritchard, owners of the enterprise now operating near Pablo Beach, outside of Jacksonville. In view of the context, which appears to give a broader application to the results than they perhaps deserve, I wish to state that the mineral identification, as well as the determination of the order of abundance, was based on a sample taken from near the works and does not necessarily hold for the deposit at large, which, as noted in the article, occupies a stretch of many miles along the coast. There is likely to be considerable variation in the relative proportions of the different ingredients, especially of those of lighter gravity. It is certain, also, that other minerals occur, in addition to those listed, which represent the more prominent species responsive to simpler tests.

The doubt cast by Mr. Liddell as to the presence of epidote seems hardly well founded. The grains so identified showed no anomalies, and I suspect the material that contained 15% of titanium to have been a mixture; at least the latter was not compared with the results of my determination.

From many points of view the deposit claims our interest. It is a most notable addition to the list of

rare-earth deposits. How the sands could lie so long in plain view without attracting notice may seem remarkable, but there is really very little in their appearance to distinguish them from any other beach sand except for their fineness and evenness of grain. Their occurrence so far from possible sources of origin in the crystalline rocks would prove a puzzle if it were not that their accumulation probably involves a long geological story with more than one cycle of concentration and deposition by water. An ultimate source in the Appalachian highland seems the most reasonable view to take, and in fact no other derivation at present appears possible. I feel that there is something very suggestive in regard to this question in the existence of the ilmenite-zircon sandstone, described by Thomas L. Watson and Frank L. Hess, from the vicinity of Ashland, Va., which is on the inner margin of the Coastal Plain, where the Tertiary beds overlap on the pre-Cambrian formations. It is at least not unlikely that the present sands have been through such a stage of consolidation and may have been gathered from a wide drainage area. D. H. NEWLAND.

Albany, N. Y., Aug. 16, 1917.

Waterproofing Leather Boots

In the *Journal* of Mar. 24, 1917, there was an interesting article about waterproofing leather boots, in which it was said that tallow is good but troublesome and nasty for the purpose.

Authorities on the treatment of leather disagree with that statement, because tallow usually has a high content of fatty acid.

The waterproofing of leather with other substances is a very simple matter, however, and it is not necessary for the miner or owner of the boots to go to the trouble of preparing his own waterproofing out of grease and old rubber boots. Any good heavy grease that is really preservative will make the boot waterproof, provided the leather is filled with it. This can be accomplished by merely painting the boots time after time and putting them in a warm place so that they will absorb it. A good belt preservative such as Cling-Surface, which penetrates and makes leather belts waterproof, will do very well, for it is soft enough to be absorbed and yet heavy enough to stay in the leather and fill all the pores. At the same time it preserves the leather, keeping it flexible and preventing cracking.

The great factor in making boots really waterproof is to use something that will fill up the stitch holes or other tiny openings. This is more difficult than filling the leather's pores. A Western boot company made a good waterproof boot for a number of years, but they failed recently and have gone into other hands. The boots the new company manufactures are not waterproof. The old company used a substance that they said was fed to the needle as the boots were sewed. Whether this is true or not, the boots, for at least a year after purchase, were waterproof.

It is my belief, however, that a good belt preservative is the proper "medicine" for filling the stitch holes as well as the leather because of the affinity of leather for such substance. I know of instances where the good waterproof boots mentioned were treated with belt preservative after about a year's use, and after they had begun to open up and leak, and were almost as waterproof and satisfactory in every way as the original boot when new. This treatment will also make the soles wear longer.

Of course a boot cannot be polished after it has been soaked full of this belt preservative, but this is true with any grease. In treating the boot it can simply be washed off clean and then put in a warm spot back of the boiler or in the door of an oven, but it must not be allowed to get very hot. Leather will stand no more heat safely than the human hand. The belt preservative is then heated and painted on the boots and worked well into the stitch holes and around the upper edges of the soles where the uppers are sewed on. Then put them back in a warm place and allow to penetrate. This application can thereafter be repeated from time to time. The time will come when there will be patches of unabsorbed preservative remaining on the surface, which will prove that the leather is saturated in those portions, and can take no more. This excess will simply have to be wiped off and the boot is ready for use. A month later, more or less, it will probably take some more preservative, particularly around the seams.

New York, July 10, 1917. N. G. NEAR.

Credits in South America

In the *Journal* of June 30, p. 1157, Case 3, I find "a New York bank canceled a 'confirmed credit'—a thing unheard of in South American banking circles." Being astonished at this action of the New York bank, and suspecting that there might be another side to the story, I have had the case investigated through banking circles and am informed on the highest authority, which I am not authorized to give at this moment, but which will doubtless be forthcoming if necessary, that this "Case 3" is not correctly stated. The correct statement is as follows:

A steel concern in this country opened an ordinary credit through this bank and its branch in South America for the purchase of wolfram, but the price having gone up, the beneficiary insisted upon a confirmed credit. This was referred to the steel manufacturer, who then asked specifically that the credit be confirmed.

The price of the material continued to rise and the South American mine owner refused to make delivery. While negotiations were in progress, the bottom dropped out of the market so that the price of the material was exceedingly low.

The South American mine owner then tendered the necessary documents to the bank, but the American manufacturer instructed the bank not to negotiate the drafts under the credit, but to consider it canceled.

This the bank absolutely refused to do. Knowing full well what it meant to give a confirmed credit the bank refused to cancel, even under threat of suit at law, and the full amount of the credit opened has been paid to the South American mine owner with full knowledge that the bank would have difficulty in collecting it from its client here.

In fact, the matter is now a subject of litigation inasmuch as the American manufacturer is suing the bank for recovery of the amount which it claims was improperly paid out.

How the matter could be perverted in the way this has been in the report of the *Journal*, I am at a loss to understand, but the foregoing are the facts in the case. TRUTHSEEKER.

San Francisco, Aug. 10, 1917.

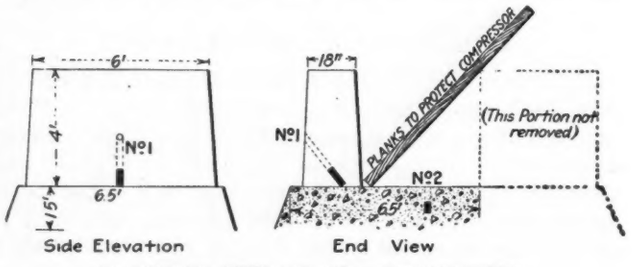
Details of Practical Mining

An Interesting Blasting Job

At a mine of the Piokee Mining Co., of Picher, Okla., an interesting blasting job was performed recently. A concrete foundation had to be removed. Owing to the shortage of labor, blasting was decided upon, although such indoor work had never been attempted before.

The foundation was on a base 1½ ft. thick, 6½ x 6½ ft. square. The pillar extending upward was 6 ft. long, 4 ft. high, 24 in. at the base and 18 in. on top. It was necessary to remove this portion in order to install a new engine in a 30 x 40 ft. engine room. The illustration shows the method used to blast out the foundation.

Two holes were drilled, as shown, at points where the charge would exert its greatest force throughout



BLASTING OUT AN OLD FOUNDATION

the mass. No. 1 hole was charged with a little less than one-half cartridge of 1¼ x 8-in. Red Cross gelatin, 40% strength, and No. 2 hole was charged with a little less than one-fourth of a cartridge. Both charges were confined by tamping fine sand in the holes.

The entire portion that was to be moved was shattered, there being only one piece over one-man size. The blasting was done in an engine room 30 x 40 ft., with a compressor 10 ft. to the right, and the side wall of the room 3 ft. to the left. A few planks were placed as shown to protect the compressor in the event of some flying particles.

No damage was done to machinery or building, and the explosive proved a good workman, as the holes were drilled, and the débris all cleared away in less than an hour's time.

Breaking Large Boulders by Heat

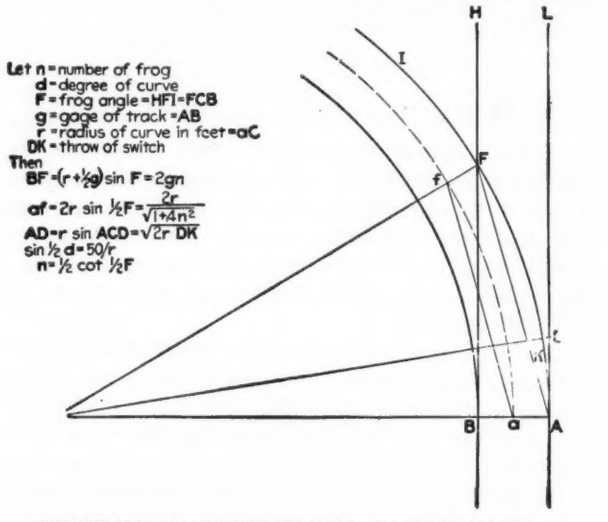
An oil-burner torch was used by the New York Subway Construction Co. in breaking up large boulders encountered in connection with its subway work in New York City, says *Engineering and Contracting*.

One of these niggerhead boulders, 8 ft. high and 10 ft. thick, was uncovered near the Borough Hall in Brooklyn. Owing to local conditions, the use of dynamite was prohibited. The contractor therefore decided to use a Hauck oil burner, and by playing the concentrated flame on one spot on the stone for 10 or 15 min. the rock was split at the seams. By repeating the operation it was reduced to a size that could be handled conveniently. The boulder was broken up in about one hour at a total cost of approximately 60c., this including the 1 gal. of kerosene consumed by the burner and the part time of two men.

Turnouts for Narrow-Gage Track

BY ROBERT S. LEWIS
Professor of Mining, University of Utah

Tables for turnouts and switches on standard and narrow (36-in.) gage railroads are to be found in nearly all handbooks dealing with railroad surveying. How-


Let n = number of frog
d = degree of curve
F = frog angle = HFI = FCB
g = gage of track = AB
r = radius of curve in feet = aC
DK = throw of switch
Then
BF = (r + ½g) sin F = 2gn
af = 2r sin ½F = 2r / √(1+4n²)
AD = r sin ACD = √(2r DK)
sin ½d = 50/r
n = ½ cot ½F
H
L
I
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f
B
a
A

DIAGRAM OF TURNOUT FOR MINE TRACKS

ever, at some mines a track 20-in. wide is used, and the following table has been constructed to facilitate the laying out of switches on a railroad of this gage.

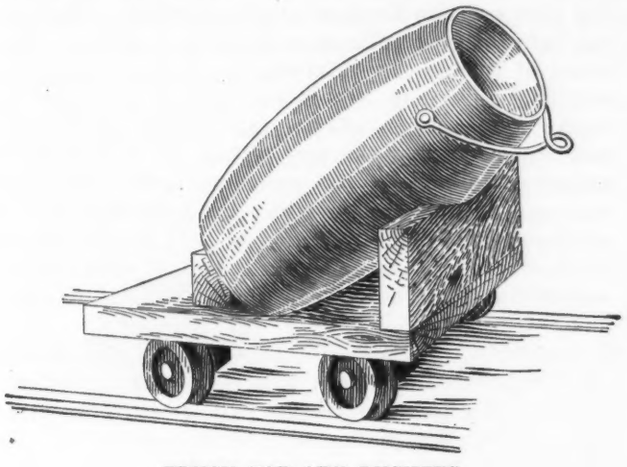
TABLE FOR 20-IN. TRACK: THROW OF SWITCH, 4 IN.

No. n	Angle F Deg.	Angle F Min.	Distance, BF	Chord, af	Switch, AD	Radius, r	Degree of Curve, d. Deg.	Degree of Curve, d. Min.
4	14	15	13.34	13.32	5.96	52.33	139	16
4½	12	41	15.00	14.91	6.70	67.50	95	34
5	11	25	16.67	16.58	7.45	83.33	73	44
5½	10	23	18.34	18.25	8.20	100.83	59	24
6	9	32	20.00	19.93	8.95	120.00	49	14
6½	8	48	21.67	21.61	9.69	140.83	41	34
7	8	10	23.33	23.28	10.44	163.33	35	40
7½	7	38	25.00	24.95	11.18	187.50	30	56
8	7	09	26.67	26.62	11.93	213.33	27	05
8½	6	44	28.33	28.29	12.67	240.83	23	55
9	6	23	30.00	29.95	13.42	270.00	21	20
9½	6	02	31.67	31.63	14.16	300.83	19	08
10	5	43	33.33	33.30	14.91	333.33	17	14
10½	5	27	35.00	34.97	15.65	367.50	15	38
11	5	12	36.67	36.63	16.40	403.33	14	14
11½	4	59	38.33	38.30	17.14	440.83	13	02
12	4	46	40.00	39.96	17.89	480.00	11	05

It is convenient to remember that no matter what the length of the chord *af* may be, its middle ordinate is always equal to $\frac{1}{4}$ *g* and the ordinates at the quarter points are equal to $\frac{3}{16}$ *g*. Should it be necessary to use another length of throw for the switches, the quantity *AD* only need be calculated. However, for a different gage a similar table must be constructed.

Bucket Truck for Mine Levels

In driving a level from a prospect shaft one of the awkward pieces of equipment to handle is the ore bucket. A great deal of difficulty can be avoided if the bucket is placed in an inclined position on the truck with the mouth facing the shoveler. A large and heavy bucket can be easily "trucked" and "caged" by the use

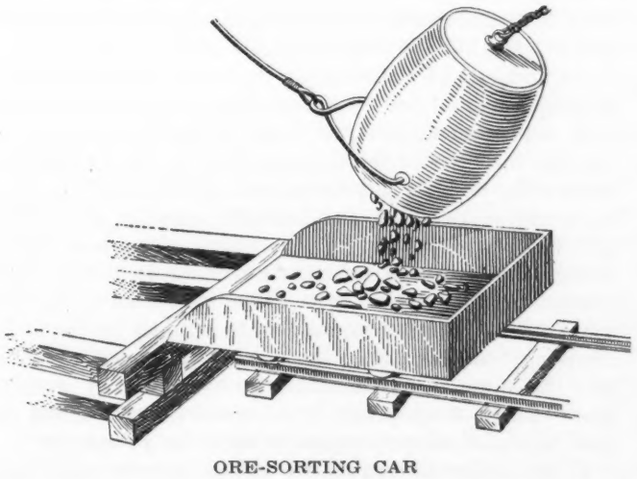


TRUCK FOR ORE BUCKETS

of the truck shown in the illustration. When the bucket is "rung down," one edge strikes the block on the truck, which, being off center, causes it to fall forward (toward the face from which the waste is being hoisted) and into the supporting block; filling the bucket at the angle at which it rests is easy. When the hoisting signal is given, the engineer takes the slack in the cable and chain and enough more to swing the bucket on to the guides or off the truck under the crosshead, the trammer steadies it and with or without another signal, according to prearranged plan, up she goes!

Ore-Sorting Car for Prospects

In prospecting shafts, when the material is hoisted in a bucket, amounts of ore are frequently brought up in the waste, which is sorted on the dump. If hoisting



ORE-SORTING CAR

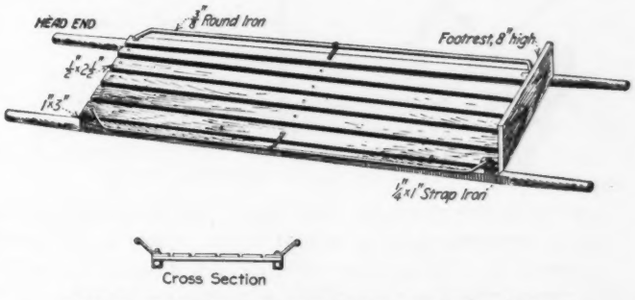
is not too rapid, a top car from which sorting may be done direct may be constructed as shown in the illustration. The bed of the car may be built in accordance with the materials available, and the arrangement for shifting should be such that the car may be kept out of the way when not needed. The dimensions of course vary with the size of the bucket used. When dumping into this car, the end of the car, and possibly both sides, will have to be supported until the material is dressed. Dumping may be a little "sudden" or a little "heavy" according to the way the material is handled in sorting, but after a short time the sorter will learn when to hold big rocks to help tip and when to throw them off to keep from tipping the car before it is time to do so.

Rigid Underground Stretcher

BY ALBERT G. WOLF
Mining Engineer, Denver, Colo.

Various kinds of stretchers for underground use have been proposed, but forms of construction involving the use of canvas, which does not give absolute rigidity, are not to be recommended. Light, folding stretchers of canvas, with folding straps, straps for holding the patient, etc., have been discussed in different publications. These canvas stretchers are convenient for those who have to carry the contrivances in and out of the mine, but in case of a mine accident, that is a secondary consideration. What is needed is a stretcher that will permit the conveyance of the injured man from any part of the mine workings—out of stopes, down manways, up winzes or shafts and through drifts, and with the least torture to him.

Such a stretcher, constructed entirely of wood and metal, is shown in the accompanying illustration. The flat, wood bed insures absolute rigidity of the patient when properly tied down. The iron side-rods are a



RIGID STRETCHER FOR USE UNDERGROUND

convenience in handling and in fastening ropes, and the foot-rest helps support the injured man when hoisting or lowering him. A quilt and several yards of cotton rope should always accompany the stretcher, the former to serve as padding and more particularly for warmth, as a severely injured man is almost always cold, owing to shock and exposure; the rope is to fasten the man securely to the stretcher. Fastening straps secured to stretchers are rarely adequate for this purpose and are often in an impossible place with respect to the injury and therefore are only in the way. The total weight of such a stretcher is 25 to 30 lb., a considerable addition to the weight of a man, yet of small moment if it saves the victim of an accident minutes or hours of pain. Having had experience both in carrying injured men and being carried from mine workings when injured, I can recommend a rigid stretcher as far superior to the usual canvas stretcher.

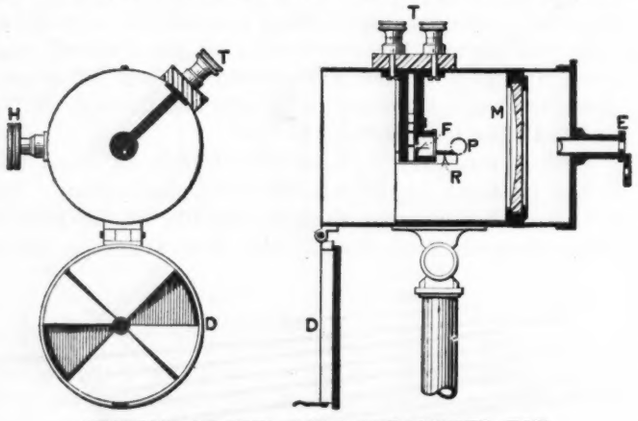
Mining and Metallurgical Machinery

A Pyrometer for the Blacksmith Shop

With the advent of oil- and gas-burning furnaces in the blacksmith shop and the more systematic methods of shaping and sharpening drill bits, the question of tempering is receiving more and more attention by the mining companies that use enough steel to warrant sharpening machines.

As stated by George H. Gilman, in "Drill Bits and Drill Steel for Metal Mining," in the *Journal* of May 12, "the eye gets off color" and "the critical point (for tempering) is reached when its rising temperature is suddenly halted by the physical and chemical changes that take place in the steel, which cause it to absorb a certain amount of heat."

Forging heat, according to Mr. Gilman, should not exceed 1600° F; tempering temperature will vary, according to the grade of steel used, this temperature being determined only by actual tests. Once determined, however, the furnace temperature can be maintained by the use of the Féry radiation pyrometer (manufactured by the Taylor Instrument Co., of Rochester, N. Y.) which not only may be used on the tempering forges, but may be made to cover the sharpening forges as well, thus giving control of the forge heat of the entire shop.



SECTION OF THE FÉRY PYROMETER FOR DIRECT READING

The instrument hitherto available had many defects. The Le Chatelier, or rare-metal thermocouple, must be protected from furnace gases, molten metals and other injurious substances, and this fact limits its use to the temperature that the protection will bear—about 2500° F., or even less for long exposure. Thermocouples of cheaper alloys are liable to rapid failure at high temperatures, no matter how well protected. Their cheapness is only in first cost, and they require frequent renewal, while their accuracy is gone, in many cases, long before they are actually burned out.

A thermocouple may give accurate readings, but the temperature indicated will be the temperature immediately surrounding its end.

Optical pyrometers—those depending on color comparison—need much skill and experience on the part of the user and also frequent standardization. They cannot be made automatic or continuous in action. Seger cones of fusible clay mixtures as used by potters are only approximations, and unless watched constantly on a rising temperature, all the information given by a melted cone is that the temperature at some time has passed some more or less uncertain limit. The Seger cone can only, at best, measure the temperature of its softening or melting point. This will be the temperature of the product under treatment, if both the cone and product have been in an evenly heated furnace for a long time.

The Féry radiation pyrometer when pointed at a hot body will give continuous automatic readings of temperature, and this temperature will be, not an arbitrary measurement, but the temperature of the body at which it is pointed. The instrument is optical only in the method of pointing; once set up and pointed, the user needs only to watch a needle as it moves over a temperature scale.

The time required to set up the outfit is less than two minutes. If readings are wanted even quicker than this, the telescope may be held in the hand. In this way the instrument may be used to rapidly explore any hot body. For instance, it can measure the temperature of steel passing through the forge or any portion of the furnace upon which it may be sighted.

With the recording outfit the telescope is fixed, pointed in the required direction and connected to a recorder, which makes a continuous record of the temperature. This recorder may be at any required distance from the furnace; records are made on paper charts in ink lines. The record can be read as it is made, while it is ready for handling as soon as it is taken from the drum. The recorder can be fitted with an alarm attachment to ring a bell whenever the temperature goes above or below any required limit; it never need go into or very near to the hot body, so that its life is not shortened by use at very high temperatures.

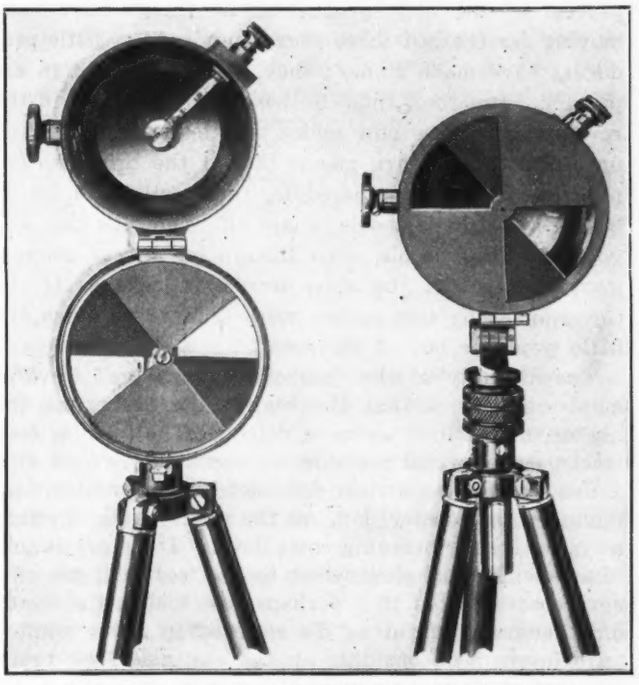
To understand the working it is only necessary to remember that all bodies radiate heat to their surroundings and the amount of heat radiated increases so rapidly with rise of temperature that it can be felt even before the body is hot enough to give out light. Heat rays can be reflected and brought together at a focus just as light rays can, so that where a concave mirror brings light to a focused image, there is also a "heat image" at the same spot. The well-known burning glass, which is used to set fire to a piece of paper by focusing heat rays from the sun, is an example of this, and the same thing that is done by a lens or burning glass can be done better by a concave mirror, and for that reason a mirror is used in the Féry pyrometer.

If two different metals are joined together and their junction is heated, an electric current will be generated. The more the junction is heated the bigger will be the current. This device is called a "thermocouple," and the place where the two metals are joined

together and heated is called the "hot junction." The place where the two metals are joined to the rest of the circuit is called the "cold junction," and it is the difference in temperature between the hot and cold junction that causes a current to flow.

The heat rays given out by a hot body fall on a concave mirror in the pyrometer telescope and are brought together to a focus. At this focus is the hot junction of a thermocouple, and as this junction is heated by the focused heat rays, the hotter the body the hotter the junction will be heated.

Referring to the illustration, a section of the pyrometer telescope is shown on the right. The mirror *M* receives the heat rays and brings them together to a focus at *F*. Here is the hot junction of a thermocouple. The cold junction is quite near the hot junction, but is



FERY PYROMETER FOR THE BLACKSMITH SHOP

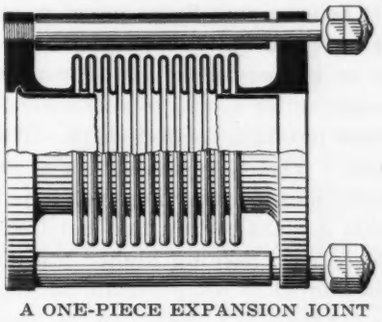
screened from the focused heat rays. Thus the two junctions are equally affected by changes in air temperature, and the difference in temperature which causes a current to flow will be due to the temperature of the hot body.

To guide the pointing of the telescope an eyepiece *E* is provided at the rear end of the telescope, through which a reflected image of the hot body can be seen. In the center of the field of view, as seen in the eyepiece, the hot junction of the thermocouple is seen as a black spot, and this must be overlapped all around by the image of the hot body. The telescope may be taken as much nearer as is desired without altering the temperature reading. As the telescope gets nearer to the hot body the mirror *M* receives more heat, but at the same time this greater amount of heat is spread over a larger image and the intensity of heat remains the same. Thus the only effect of going nearer to the hot body is to increase the amount of overlapping of the image beyond the black spot. This distance can be as much as thirty times the diameter of the hot body.

The telescope is focused by turning the milled head *H* at the side, a simple operation; an indicator may be connected to the telescope by a flexible cable. This indicator measures the current generated by the thermocouple in the telescope and reads the temperature of the hot body direct.

One-Piece Expansion Joint

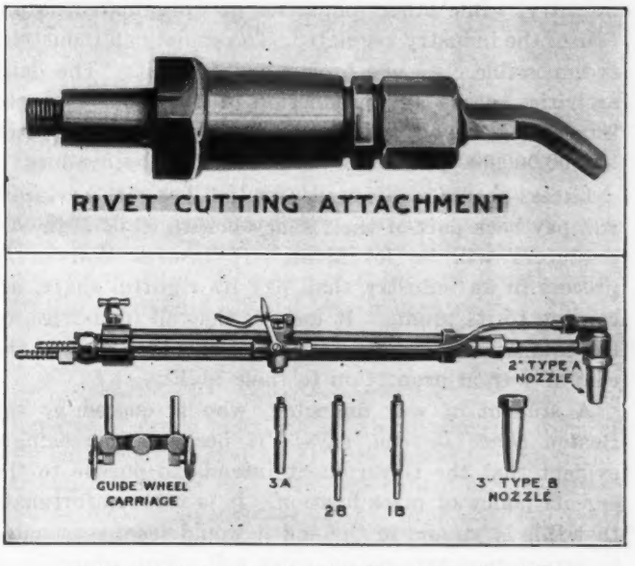
A one-piece expansion joint that requires no packing has recently been placed upon the market by the Nuttall Manufacturing Co., of Pittsburgh, Penn. This joint is made of a hammer-forged oil-tempered steel blank and is made for both high and low pressures. The accompanying illustration shows in cross section the general design. The total sweep of the joint varies from $\frac{5}{8}$ in. in the low pressures to 2 in. in the high pressures.



A ONE-PIECE EXPANSION JOINT

Rivet-Head and Stay-Bolt Cutter

For cutting off rivet heads and stay-bolts flush with plates, by the oxyacetylene process, it is desirable to have a cutting tip so designed as to permit the gas jet to play parallel with the plates. To meet this need the Prest-O-Lite Co., Inc., of Indianapolis, Ind., is manufacturing a special rivet and stay-bolt cutting attachment. This is used in connection with the Type K cutting blowpipe shown, being screwed into the head in place of the regular cutting nozzles. The copper tip is bent at a convenient angle and is adjustable to any position, facilitating operation in close quarters. Much cleaner work in rivet and stay-bolt cutting is possible with this attachment than with standard cutting tips, which do not permit of a cut truly parallel with the plates.



RIVET-HEAD AND STAY-BOLT CUTTER FOR OXYACETYLENE BURNER

Price Fixing

Wall Street is remarking that if the Administration's plan of fixing "one price for all" for various commodities is not actually unconstitutional, it would in any event be found impossible of enforcement, says the *Evening Post.* Whenever it stops to think of it (and that has lately been a frequent occurrence), its mind breaks down in confusion. It cannot see the beginning or the end. It believes that fixing prices to all consumers would have certain definite results, but it believes it would be just as impossible for it to have the desired results as it would be for a man to take a handful of water and squeeze it into a desired shape. The old difficulties reappear. The Government could fix prices for the large companies, for they are easy to put one's hand on; but could it make certain that hundreds of smaller concerns were not charging higher prices? Would not buyers who wanted to make certain of getting goods bid secretly for them at higher than the fixed price? That they could afford to pay more is proved by the fact that they are at present doing it.

And the question of unfairness bobs up on every side. Must high-cost producers go out of business in order that low-cost producers shall not reap fancy profits? If the price of steel is fixed, will pig-iron and iron-ore prices be fixed? Will the prices of all finished products be fixed? If prices are fixed in half a dozen large industries, why should they not be fixed in all industries? For prices have risen in nearly all industries. To regulate one industry, or the product of one stage of one industry, while other industries go unregulated, is unfair to the industry regulated. To regulate all industries is impossible. As one broker expressed it: "The daily activities, needs and production of 100,000,000 people, interacting, have fixed prices. The prices hitherto fixed by 100,000,000 people are now to be fixed by five men.

Excess-profits taxation insures that low-cost producers will pay back part of their fancy prices, while high-cost producers will be let alone. It insures that every process in an industry shall pay its rightful share, according to its profits. It insures that all industries, of the country indiscriminately, shall shoulder part of the cost of war in proportion to their ability.

A student of war financing, who is quoted by the Boston *News Bureau,* says: "It becomes increasingly evident that the Government intends to pursue to the end its policy of price fixation. It is most unfortunate that this is so, and in the end it would seem reasonable to expect that this policy must fail. But affairs in a republic are run not always effectively and often unwisely. It seems probable that Washington must pursue this price-fixing program until it has broken down and proved its impracticability.

"The wiser course for the Government to pursue would seem to have been to allow economic laws to play their natural part even though this involved some excessively high prices. Extortionate profits would have automatically reverted back to the Government in the form of taxes. Under a policy of price fixation the excess-profits tax is morally bound to suffer severe shrinkage. And if this shrinkage is not severe enough to upset the entire taxation program, it will be one of the wonders of the age.

"Price fixation, if persisted in logically, is bound to bring with it liquidation of labor. There is a deal of talk about the six-hour day. The striking miners of Butte are demanding it. And the papermakers' unions are hot on its trail. How a country with millions of drafted men is going to reduce prices, assimilate a six-hour day and not reduce wages very drastically, passes the comprehension of anyone who keeps to the fundamentals of finance.

"Another serious side of the price-fixation policy is that it means the elimination through a cruel grinding process of the little producer. As things have been moving for the last three years, hundreds of little producers have made money; they have reinvested in expansion. But their financial base is fragile, and in the revamping process now under way many cannot stand up. And this in turn means that if the price-fixation program is rigidly adhered to, there will be a lot of business that little people cannot afford to take that will go to the big people, even though on a very narrow margin of profit. In other words, it looks as if the Government by this course were tending to drive the little producer out of business."

The difficulty of the "cost-plus-percentage" Government contract is that the higher the cost runs the higher the profit in terms of dollars. The form of contract puts an actual premium on inefficiency. Cost plus a fixed profit per article does not put a positive premium on inefficiency, but, on the other hand, it offers no incentive for bringing costs down. The story is told of a New England plant which took a "cost-plus-percentage" contract—but it is perhaps best told in the words of a company official: "We were asked if we wanted any Government business on the cost-plus-10% basis. We replied that we were full up with orders and did not care for any business on that basis. We were then invited to name our prices, which we did, and the Government booked another million of business with us. Not far from us a contractor is building a cantonment on the Government's cost and percentage basis. He started with labor at 23c. an hour. The moment his cost and percentage basis was known, the men advanced their wages to 45c. an hour. The result was to make more money for the contractor, increase the wages and decrease the efficiency of the men, and 1500 men were drawn away from plants nearby already doing Government business."

NEVADA WONDER MINING CO. reports that during the 15 months ended Dec. 31, 1916, 72,241 tons of ore was treated for the recovery of 10,933 oz. Au and 1,243,753 oz. Ag, the ores averaging 0.159 oz. Au and 18.72 oz. Ag, with a total average value of $15.40 per ton. Costs were: Mining, $5.33; milling, $3.31; marketing, $0.26; total, $8.90. Loss in tailings was $1.13; recovery, $14.27; profit, $5.37 per ton of material mined and milled. Two dividends of 10% each were paid during the period, and 5% of the total dividend, amounting to $6043, was distributed among the employees who had been in the service of the company for one year or over.

Industrial News from Washington

BY OUR SPECIAL CORRESPONDENT

New Stations of Bureau of Mines

The three newly authorized stations of the United States Bureau of Mines will specialize in ceramography, ferro-metallurgy and petroleum research respectively.

The one to be devoted to ceramic research will be situated at Columbus, Ohio, in charge of R. T. Stull, who is a ceramic chemist. Though having much money invested, the ceramic industry has not been progressive, due, it is said, to lack of technical knowledge. There is also great waste of fuel in this industry. As fuel represents 20% of the value of the wares produced, means for saving it will be especially studied at the new station.

The station for research in ferro-metallurgy will be situated in Minneapolis. The name of the superintendent will be announced later. The work will be confined to problems of iron mining and will be pursued in coöperation with the School of Mines of the University of Minnesota. It is mapped out by Director Manning as follows:

To devise means of concentrating 35-50% hematite ores profitably and of concentrating magnetite ores, especially those of the eastern end of the Mesabi range.

To discover a way of concentrating low-grade manganiferous ores from the Cuyuna range so as to lower their phosphorus content to the point where they may be used.

To solve the problem of smelting the titaniferous ores of northeastern Minnesota.

The station will, moreover, probably join with the State of Minnesota in investigating the methods of mining iron-ore deposits on state lands, which include 34 properties, estimated by the United States Geological Survey to contain 35,000,000,000 tons of iron ore. An effort will be made to determine whether commercial lean ores have been left in mining operations.

The situation of the station for petroleum research has not yet been announced by Director Manning.

Metallurgical Effort to Win War

That Verdun was a metallurgical battle is pointed out by Dr. G. K. Burgess, chief metallurgist of the Bureau of Standards and a member of the American Scientific Mission recently returned from Europe. Verdun is a salient into the German lines, dangerously close to the great iron-mining region which is held by the Teutons. For this reason Dr. Burgess believes that there will be no cessation of stupendous efforts made by the contestants at Verdun.

Under the stimulus of the sternest of necessities, the French and English have made gigantic strides in metallurgical practice, Dr. Burgess reports. He is particularly impressed with the great development in the hydro-electric plants in the French Alps. Many happy surprises are certain to come to American metallurgists and chemists when, with the coming of peace, the progress that has been made can be set forth in perspective.

Since in European practice it has been possible to eliminate piping in the casting of ingots, Dr. Burgess is of the opinion that American manufacturers must turn out a sounder type of ingot. Steps also must be taken, he thinks, to spur all the metallurgical industries to a higher state of efficiency. The volume of output must be increased to points heretofore considered impossible of attainment. Comparatively few persons in America realize the magnitude of the struggle in which we are engaged, Dr. Burgess believes, and while he thinks the war is won for the Allies as certainly as if the decisive engagement were already fought, he points out that stupendous metallurgical effort will be required before our enemy can be induced to lay down arms.

Production of Iron Ore in 1916

Iron ore mined in the United States in 1916 was 40% greater in quantity and 80% greater in value than the 1915 output, according to the figures of the United States Geological Survey. The average value per ton at the mines in 1916 was $2.34. The states leading in production are Minnesota, Michigan and Alabama, with increases over their 1915 output of 33%, 44% and 27% respectively. The Lake Superior district produced 85% of the total, while but 8% came from the Birmingham district.

The Hull-Rust mine at Hibbing, Minn., produced 10% of the country's 1916 output, or 7,658,201 tons. Red Mountain mine, near Bessemer, Ala., comes second with 2,899,588 tons. Fayal mine at Eveleth, Minn., and Mahoning mine at Hibbing are third and fourth with 2,252,008 tons and 2,215,788 tons respectively.

Mineral Imports Increase

Imports of crude material, of which minerals form a large part, were valued at $1,110,000,000 for the fiscal year ended June 30, 1917, the Department of Commerce reports. This is an increase of 42% over the fiscal year ending in 1914, just preceding the outbreak of the war. Important items in the increase were unrefined copper ingots, nitrate of soda, and tin in bars.

Greater Interest in Strontium

The English embargo on strontium salts and the possibility of using them in sugar refining have caused increased interest in the mining of strontium minerals, according to the Geological Survey. Known deposits in Arizona and California, recently investigated by the Survey, are being actively worked and much prospecting is being done.

Events and Economics of the War

Pope Benedict's peace proposals, irrespective of their terms or inspiration, seem likely to draw from the belligerents a statement of their war aims. British labor unions endorse by a margin of 3000 the plan to send delegates to the Stockholm council, the total vote cast being 2,500,000. The council is not approved of by Gompers.

Langemarck has fallen to the British in Flanders and further ground at Ypres and Lens. The French have broken the German lines at Verdun and the Italians have gained toward Trieste. The Russian front is quiet. Mackensen continues his minor successes in Moldavia. China has declared war on the Central Powers and Japan pledges a fight to the finish.

In this country, the Government has formed the Wheat Corporation to control the 1917 crop. The President has fixed the price of soft coal. The National Guard is making ready for France. A second liberty loan of 7½ billions at 4% is recommended, the first loan to be retired. At Spokane, troops seized 27 I. W. W. members who may be tried for treason.

Hoover's Wheat Corporation

The Food Administration has formed a $50,000,000 wheat corporation to buy and sell wheat at the principal terminals, as a step preparatory to taking over the 1917 wheat crop. All stock is held by the Federal Government.

The executive officers of the corporation are: Herbert C. Hoover, chairman, Julius Barnes, Duluth, Minn., president, Gates W. McGarrah, New York, treasurer, F. G. Crowell, Kansas City, vice president, Edward Chambers, Chicago, transportation director, Curtis H. Lindley, San Francisco, counsel, J. W. Shorthill, York, Neb., secretary.

The Wheat Corporation will be under the Administration's grain division which will be represented, as follows, at the terminals named:

Edward M. Flesh, at St. Louis, M. H. Houser, Portland, Ore., C. B. Fox, New Orleans, H. B. Irwin, Philadelphia, P. H. Ginder, Duluth, Frank L. Carey, Minneapolis, George S. Jackson, Baltimore, H. B. Jackson, Chicago, Charles Kennedy, Buffalo, R. A. Lewin, San Francisco, D. F. Piazzek, Kansas City, Charles T. Neal, Omaha.

The committee that will fix the price of wheat comprises the following men:

Harry A. Garfield, president of Williams College, chairman; Charles J. Barrett, Union City, Ga., president of the Farmers' Union; William N. Doak, Roanoke, Va., vice president of the Brotherhood of Railroad Trainmen; Eugene E. Funk, Bloomington, Ill., president of the National Corn Association; Edward F. Ladd, Fargo, N. D., president of the North Dakota Agricultural College; R. Goodwyn Rhett, Charleston, S. C., president of the Chamber of Commerce of the United States; J. W. Shorthill, York, Neb., secretary of the National Council of Farmers' Co-operative Association; James W. Sullivan, Brooklyn, N. Y., of the American Federation of Labor; L. J. Tabor, Barnesville, Ohio, master of the Ohio State Grange; Frank W. Taussig, chairman of the Tariff Commission; Theodore N. Vail, president of the American Telephone and Telegraph Co.; Henry J. Waters, president of Kansas State Agricultural College.

Agencies will be opened at the terminals named and transactions will be carried on with the usual dealers through the regular channels. "If found advisable," says the New York *Times*, "the Corporation also will serve as broker for the milling interests, purchasing wheat for the flour mills, to keep the market steady. The Allies will be required to purchase flour instead of wheat, on the theory that manufacturing costs will be reduced and American industry encouraged.

"All of the grain men who are taken into the Food Administration's grain division will dissociate themselves from business interests and will give their entire time to the Government without remuneration.

"Authority to license grain elevators and milling concerns was given to the Food Administration in a proclamation by President Wilson. Mr. Hoover hopes that operation of the licensing system will make unnecessary any extensive Government purchases of wheat, except for the Government itself and for the Allies. He believes a stable export price and proper supervision of exchange dealings will do more than anything else to keep prices on a constant level."

Another Appeal for Car Saving

Because the demand for freight cars is greater today that ever before in the history of the country, and is increasing daily, the Commission on Car Service of the Railroads' War Board has issued a second appeal asking still further coöperation from both shippers and receivers of freight. The Commission states that the ability of the railroads to move crops depends largely upon the full loading of cars and the elimination of all delay in loading and unloading them.

The movement of lumber to the cantonments and the shipping yards has monopolized the use of more than 100,000 cars and made serious inroads into the supply that under normal conditions would handle the movement of crops and food products. To offset this handicap and secure the maximum amount of service from the cars that the nation is dependent upon for the transportation of food supplies, the following suggestions are made to shippers and receivers:

Unload promptly all loaded cars received; load promptly all outgoing cars and release them immediately to the railroad; anticipate disposition of freight before its arrival; do not order special types of cars when ordinary types will serve; eliminate use of railway equipment when tonnage can be handled by motor trucks or wagon; load all cars to their full carrying capacity.

The Commission on Car Service points out that there are six ways in which the loading of cars to their full carrying capacity can be achieved, and enumerates them as follows:

More careful supervision of loading; producers and buyers agreeing to disregard established trade units and increase the units as a war measure; waiving rights in regard to minimum weights under tariff and traffic regulations; buyers increasing their orders so as to fill the car, and producers disposing of their output on a basis of full carrying capacity of equipment furnished; buyers who cannot handle larger quantities clubbing together with other buyers to make full-capacity cars; showing customers who desire, merely as a matter of convenience, smaller units than maximum how they can help the general situation by enduring inconvenience.

Reports from practically all parts of the country indicate that the movement of grain and food products is going to be especially heavy during the next few months. As more than 600,000 recruits for the draft army will have to be transported to the cantonments next month, and as similar unusual traffic movements produced by the war are pending and threatening severe congestion, the Railroads' War Board feels that everyone should coöperate in the movement of freight.

"Keep the cars moving with a full load and settle differences of opinion afterward!" is the War Board's advice.

Points About Potash

Ever since the war started, according to the *Boston News Bureau*, there has been a deal of newspaper publicity given to potash discoveries and new sources of potash supply in the United States. It was part of the cleverness of the Germans that through their propaganda they planted in the minds of Americans an exaggerated idea of the value of potash. Thousands of Americans even today believe that potash is the most essential instead of the least essential element in artificial fertilizers.

It is only fair to admit, however, that the progress of this country toward discovering new sources of potash has been most disappointing. Government figures show that in 1916 there was produced in the United States 8830 tons of potash. This was valued at about $3,000,000, or 10 times its ante-bellum price.

The output in 1917 will unquestionably be much larger, but even if by some unexpected stimulus it should reach 20,000 to 25,000 tons, it would be but a small fraction of the normal consumption of the United States, which amounts to about 1100 tons daily. In other words, at the best we cannot hope in 1917 to make more than one month's production of potash.

Perhaps the best thing that has been done in the potash line has been to discover substitutes. Some very effective work has been done along this line. In some manufacturing concerns new chemical reactions with other and cheaper minerals substituted have actually worked out better than in the potash days. It is safe to say that the wiles of the Kali syndicate will not tempt these people back to the use of potash.

A lot of talk is being made about the extraction of potash from kelp on the Pacific coast. Something has been done in this direction. In 1916 about 1100 tons of potash were recovered from kelp. It is not a difficult proceeding, but is done on a basis that would not be commercial with muriate of potash selling on the normal peace basis of about $32 to $35 per ton. It works all right when this same grade of potash salts has jumped to $350 or $400 per ton and is not obtainable at this figure.

About 20 tons of potash is being made daily from alunite ores by a concern in which Boston capital is incidentally interested. It is understood, however, that the process is not a full success for the reason that it was expected to recover both potash and the ore from which aluminum is made. The potash has been recovered, but the aluminum end is not a success, with the result that the potash is costing far too much even at existing abnormal prices.

How Can Our Boys Fight Without Guns?

The following editorial, appearing in *American Machinist* in the issue of Aug. 16, 1917, under the above title, is accompanied by the statement of the editor that the charge is based not simply on editorial knowledge of the facts but on incontrovertible proof, photographic and otherwise, in the editor's possession.

"This editorial is not an attack on any individual, but on a system.

"Suppose, Mr. Manufacturer, with emergency orders filling your shop, you should discover that through a lack of executive decision your workmen had been forced to kill time by playing checkers and cards during working hours! What would *you* do with the man responsible for this condition? Would you accept *any* excuse from the official who exercised full authority?

"Scores of skilled rifle makers in one of our best-known American plants have been for weeks and are today retained on the payroll, killing time with checkers and cards during working hours, simply because certain officials have been unable to arrive at a decision regarding details. This work is being done on a 'cost-plus' basis for our Government, so that you and I must pay these men for killing time. But this is of small moment compared to the inexcusable and dangerous loss of time in making our new army rifles.

"These mechanics are not responsible for this condition. The shop management is not responsible for it. Somebody is. Who is it?

"England was forced by bitter experience and delays of this kind to eliminate bureaucratic control of all munition manufacture and place this work in the hands of those qualified by experience to decide quickly between the essential and the non-essential.

"Experienced engineers and works managers are the men who should decide upon specifications, manufacture and inspection.

"We have not published these facts without due deliberation. But we believe that truth in this matter is more important than the personal feelings of well-intentioned officials whose duty it is to decide on specifications but who are incapable of coming to a decision.

"Months after war has been declared—months after the type of our rifle has been determined—it is a crime

against our boys who will bear rifles at the front to permit American rifle makers at home to pass week after week playing checkers and waiting for something to do."

Manning on Gasoline Economy

The following statement of Van H. Manning, Director of the Bureau of Mines, in regard to the gasoline situation, appears in the *Official Bulletin*.

"One-half of the gasoline used in the United States (1,250,000,000 gal.) is used in pleasure riding. It is estimated that the United States Army will need 350,000,000 gal. for airplanes, trucks, automobile tractors, etc. There is no way of obtaining this in this country except by saving from the existing supply, and this economy may be effected by voluntary cutting down of pleasure riding.

"It has been estimated that by economical use enough gasoline can be saved to supply not only the United States but also its allies for war purposes.

"The following suggestions should be observed by automobile owners: (1) Do not allow your engine to run idle; (2) use kerosene, not gasoline, for cleaning purposes in the garage; (3) see that the carbureter does not leak, and form the habit of shutting off the gasoline at the tank; (4) by judicious regulation of the mixture of gasoline and air in the motor, both greater power and economy of fuel may be obtained.

"Automobile owners need not lay up cars, but should use them either for trade or pleasure purposes thoughtfully and judiciously. If this advice is followed there will be no undue scarcity, for the United States possesses an abundant supply for ordinary purposes."

Steel Industry After the War

"Before the war the maximum steel capacity of the United States was roughly 27,000,000 tons a year," says the Boston *News Bureau*. "Great Britain was capable of something under 7,000,000 tons a year and Germany's capacity has been placed at 22,000,000 tons. These three big steel-producing countries of the world represented together a productive capacity of 56,000,000 tons.

"As a result of tremendous plant expansion in the past two years the United States today has a steel capacity of practically 47,000,000 tons a year and England is now outputting at the rate of close to 12,000,000 tons. Obviously, nothing authentic on the German situation can be had, but there is no doubt that under the necessity of supplying the munition requirements of Austria and Turkey, as well as its own, Germany has undoubtedly increased her steel output tremendously. In fact, it is probably safe to place her output at 30,000,000 tons a year.

"In other words, the combined steel capacity of the United States, Great Britain and Germany is now 89,000,000 tons, whereas before the war it was but 56,000,000 tons. Considering the normal aggregate world peace demand before the war was only 60,000,000 tons a year, the one conclusion is that when peace returns the excess capacity to be utilized will necessitate a sharp reduction in prices, for the laws of supply and demand are bound to continue.

"The tremendous reconstruction demand of a devastated Europe will increase for some time the normal peace demand, but there are those who feel that when the demand from this source subsides, another big world-wide readjustment of the steel industry will have to take place.

"The question of the future will be how far the vastly expanded steel-making capacity conjured into being by imperative needs of war will in a new era of peace—perhaps with radically altered alignments of trade competition and geography—find new or enlarged uses for steel in older countries and perhaps now undreamed of potential demands from newly developed countries such as Russia."

Women in Technical Industry

The extent to which men have been replaced by women in the English metal and chemical industries is partly shown by photographs in recent issues of the *Coal and Iron Trade Review*. Exhibits have been held at Bristol and Leeds of samples and photographs of women's work.

At the Leeds exhibit, says the *Review*, women "were shown daubing coke-oven doors, discharging and quenching coke, stacking and loading it into wagons, receiving it from aërial ropeways, and doing general laboring. In a rolling mill they were shown carrying rails to the saw, operating the saw, and punching spike holes in light rails, as well as charging the furnaces of the rail mills. They were shown also doing a variety of work, such as the preparation of light railway trucks and the drilling of points crossings for heavy tracks.

"In a chemical works they are seen carrying molten naphthalene in a ladle and breaking it up, operating the benzol washer, loading trucks, etc. In a steel works they were depicted marking and nicking billets with the oxyacetylene blowpipe, operating the hydraulic charging of a continuous furnace, feeding reheating furnaces and scaling hot billets, operating hydraulic presses, and doing a variety of laboring work. In a foundry they were shown making cores, both by hand and machine, doing machine molding, skin-drying molds, mixing sand in the pug mills, operating the band saw and grinder in the fettling shop, and doing general laboring work."

It is desired to point out, not that war has forced women into such work in the absence of men, but that such work and others like it can be done by women, doubtless much less efficiently than by men, but still sufficiently well to cause their continuance in it after peace has come.

Toluol from City Gas

There is a scarcity of toluol for making high explosives, and the chemical committee of the Council of National Defense is taking steps to have the gas supply of large cities stripped of this byproduct. This will change the nature of gas to some extent, but it will be treated in other ways to maintain a satisfactory illuminating standard. Gas consumers in cities will have to become accustomed to a different kind of gas. Toluol is used in making trinitrotoluol, one of the most valuable high explosives.

Editorials

The Matter of Coal Prices

The President has spoken as follows:

The following scale of prices is prescribed for bituminous coal at the mine in the several coal-producing districts. It is provisional only. It is subject to reconsideration when the whole method of administering the fuel supplies of the country shall have been satisfactorily organized and put into operation. Subsequent measures will have as their object a fair and equitable control of the distribution of the supply and of the prices not only at the mines but also in the hands of the middlemen and the retailers.

The prices provisionally fixed here are fixed by my authority under the provisions of the recent act of Congress regarding administration of the food supply of the country, which also conferred upon the Executive control of the fuel supply. They are based upon the actual cost of production and are deemed to be not only fair and just but liberal as well. Under them the industry should nowhere lack stimulation. (Signed) WOODROW WILSON.

It is unfortunate that so many statements from Washington, even by the President himself, are made in such cryptic language. This statement of Aug. 21 leaves us in doubt as to whether the President is fixing a coal price for the Government alone or for the public generally. If the latter, the meaning is that the Government has ventured upon a great experiment, leaving it for time to tell how it is going to work. Let us hope that industrial disorder will not be permitted to go beyond the line of easy correction. The President leaves a loophole for himself in his qualification that his present scale of prices is only provisional.

Of course, no one of knowledge imagines that the President himself has investigated coal mining conditions all over the country. Probably what he has done is to take the reports and opinions of clerks in the Federal Trade Commission, summarized and endorsed by the lawyer heads of that Commission. The opinions of the industry are discredited. Prices fixed on Aug. 21 are practically $1 a ton below the scale drawn by the Peabody Committee after a conference with 400 coal operators last June. This was the conference at which Secretary Lane praised the coal men for their patriotic action in cutting prices. The action of that conference was repudiated by Secretary Baker, and Secretary Lane was consequently discredited. Now he stands discredited by the President, while Daniels and Baker are jubilant.

Miss Rankin's Views

Miss Rankin, having signalized herself in Congress by some foolish remarks respecting the economics of the copper industry, took it upon herself to champion the cause of the striking miners of Butte and said, among other things:

The conditions of the mines (of Butte) have grown more and more unsafe. I have had heart-breaking letters from the wives of some of the miners, saying that when their husbands went to work in the morning they never knew whether they would ever return, and that they lived in constant anxiety. On June 8, 160 men were burned in a fire in one mine. This was the climax. The men stopped work. The workers knew that they would never be safe as long as the rustling card system existed, for under that system every man who complained of conditions or reported dangers or endeavored to form an organization was laid off for one reason or another, and it would be impossible for him to obtain work again in any mine in Montana or elsewhere.

When she said those things, Miss Rankin doubtless supposed that she was voicing genuine grievances of the miners of Butte. But before she said them it was her duty as a member of Congress to ascertain if they were correct, although we grant that it is the fashion among members of Congress to make allegations based only on gossip, hearsay and idle expression of opinion that would not obtain credence in any respectable business office. If Miss Rankin had taken the trouble to inquire she could easily have learned these facts:

1. That the accident rate in the mines of Butte has been diminishing, wholly through the efforts of the operating companies, which have a selfish interest (if no other) in reducing it in order to save expense under the Workmen's Compensation law.

2. That the terrible disaster of June 8, in the North Butte mine, was due to the criminal carelessness of a workman, for which the North Butte company was in no way responsible morally.

3. That the "rustling card" system has nothing to do with the dangers in the mines. On the contrary the companies welcome any reporting of hazardous conditions for the reason stated under article 1 (if no other). The much criticized "rustling card" system is simply the establishment of credentials of good character, working record, etc., for applicants for work to foremen of operations that are scattered over a large district, who are individually unable to investigate the standing of the applicant. The rustling card is equivalent to the letter of recommendation that may be given to a chauffeur or a gardener and takes the place of the inquiry that anybody makes before taking somebody into his employment.

4. That if the miners of Butte are not satisfied with the safety measures that the companies have taken, all they need to do is to elect a legislature that will amend the rather defective mining law of Montana; and the U. S. Bureau of Mines issued several years ago a report on this subject comprising a specific draft of what an adequate state law ought to be.

All of these things could have been ascertained by Miss Rankin, but she preferred to accept the disingenuous mouthings of the I. W. W. agitators, whose avowed purpose is to destroy industry, produce anarchy, repudiate all claims of country, and who boast of their employment of dynamiting and assassination in order to accomplish their evil ends. The alliance between Miss Rankin and William D. Haywood would be humorous if it were not so pitiful, and we may add so unpatriotic in the present juncture.

All this is quite apart from Miss Rankin's main proposition that the copper mines be taken over by the Gov-

ernment. This was simply an emotional and sensational appeal that exhibited an absolute ignorance of government and economics, or such a perverted conception thereof as might be entertained by the I. W. W. To Miss Rankin the owners of the copper mines are rich men. She seems to think that John D. Ryan is the owner of the Anaconda, disregarding the fact that the owners are 20,000 persons, many of them poor men and many of them women, widows and orphans. To Miss Rankin the miners are the only poor men and some of them are discontented. Therefore let the Government take the mines and see if that won't make the miners happier. If the Government will not do that—and Heaven knows it has got enough on its hands—let's see what more may be got out of the 20,000 persons who comprise the company.

Is it to be wondered that when Miss Rankin makes her sensational visit to Butte and offers her services as mediator, the companies knowing her views refuse to accept her offer? Is it to be wondered that 10,000 miners applaud her in a mass-meeting? If Miss Rankin wants to do real service to her state and to her country, she will go back to Washington and work for the passage of a bill to incarcerate or execute the agitators who are preaching sedition and treason. If some of those people were apprehended it is not unlikely that the labor troubles would cease quickly.

Quelling the Labor Disorders

The insidious German propaganda works in the same way in several countries, especially in Russia and the United States. In both it seeks to seduce the pacifists, the mild socialists and the dreamers of an economic millenium. In both it incites the anarchists—the Bolsheviki in Russia and the I. W. W., their American counterpart. There is strong ground for the suspicion that the activities of those gentry are inspired by German money, shrewdly distributed among their leaders.

A courageous officer in Spokane arrested one Rowan and 26 of his followers and put them in jail as military prisoners, whereupon the general strike with which he had threatened the Northwest failed to materialize. This confirms the belief that many persons have entertained, namely, that if a few of the noisy, malevolent leaders should be summarily abstracted from the ordinary walks of life the labor troubles would promptly cease.

The Price for Silver

The price for silver has risen to the highest figure on record since the early '90s. The reason is simple, namely, the hoarding of gold by all the nations of the world and the increased use of silver to take the place of it as currency. With the expanding issues of paper money there is a tendency toward the hoarding of silver itself. At the same time the absorption of silver by the East for its usual purposes has been very large. So much for the demand. On the other hand the production may have decreased. We do not venture to say that it has decreased, for the statistics of silver production are not very up to date. However, until recently the rise in the value of silver has hardly been commensurate with the increase in the cost of mining, and that in itself would tend to discourage the production of silver.

German Steel Production

German steel production has kept up since the beginning of the war to nearly 70% of the total of 1913, which was a year of high output. For some reason not clear, the monthly reports of the German Iron and Steel Union, regularly issued up to that date, have been suspended since October last. For three years past the make of steel has considerably exceeded that of pig iron, a matter which is readily understood, when we remember that the German demand has been chiefly for finished steel in its various forms, and that much the larger part of the make has been basic openhearth steel, permitting the use of a large proportion of scrap. The total production of steel, according to the Union reports, was 13,188,019 metric tons in 1915; in 1916, estimating November and December as closely as possible, it was 16,050,000 tons, or nearly 2,800,000 tons more than in the previous year; an increase of 21.7%.

This is a remarkable result, all things considered. No doubt the government has been careful not to draw too heavily on the working forces of the steel mills and their auxiliary mines and coke ovens, realizing the necessity of maintaining the supply of war steel. Fuel has certainly been in sufficient supply since the German coal-mining districts have not been touched by the war except so far as the labor supply may have been concerned; while some additional supplies may have been drawn from Belgium.

The only iron-ore supplies which have been cut off are the high-grade bessemer ores from Spain and those have never been important in the German iron trade. The great supply of that trade, the minette ores of Lorraine and Luxemburg, have been under German control for the most part, and it has been possible to obtain ores from Sweden to any extent needed.

Whatever may be the reason for suspending the monthly returns, it does not seem probable that any great decrease in production was one of them. It is not prudent to underestimate an enemy's resources, and we cannot calculate on a shortage of steel for German munitions—at least until Essen and the Rhenish Westphalia districts are covered by the Allies' lines.

Australia continues to show material decreases in its gold output. In the first quarter of the current year the four important gold producing states, Western Australia, Victoria, Queensland and New South Wales, showed decreases from last year varying from 10 to 30%, the average of the whole being nearly 20%. This decrease is in large part due to reduced forces at mines and general shortage of labor. In Queensland a special cause was found in a strike at the great Mount Morgan mine, now worked chiefly for copper, but still a large gold producer. Coupled with the labor conditions—and partly in consequence of them—is an almost total absence of prospecting and new exploration. No new gold deposits have been opened, and extensions of existing mines are few and far between, while public interest in gold mining is far from active.

BY THE WAY

In the *Canadian Engineer* E. R. Bingham gives an easy rule for approximating the number of acres in a given number of square feet. This is: Multiply the number of square feet by 23, point off six decimal places and deduct 0.002 for each acre. For example, 43,560 × 23 = 1,001,880 (a difference of 0.001,880). Deducting 0.002, the result would be 0.999,880, an error of 0.00012. For 10 acres the actual difference would be 0.0012, for 100 acres, 0.012—for many purposes close enough.

Irrelevant questions are not always confined to those asked by the small boy. A "scout" for a mining company happened to run across a prospector who was sinking a shaft. "Hello, friend, what you digging for?" he asked. "Cheese," replied the prospector. "Cheese? What do you mean?" "Well," said the prospector, "I got a d——d good cracker ledge on the other side of the gulch, and if I find cheese and then get down deep enough I may hit beer, that'll be almost a grubstake—then I'll hunt one of them there dissipated coppers you fellows want."

Under the title "Mr. Hoover's Conquests," the New York *Times* of Aug. 22 says: Business men who had witnessed the Food Administrator's complete triumph over the Chicago Board of Trade, to say nothing of the New York Produce Exchange and all the other grain markets, were not surprised to hear yesterday that he had also brought the New York Coffee and Sugar Exchange into line. Trading in sugar futures was an infant industry compared with the trading in grain futures, and not apt to give Mr. Hoover much trouble after what he had already accomplished, but it is worth mentioning that the committee of sugar men who went to Washington to confer with him returned chanting Mr. Hoover's praises if anything more enthusiastically than the grain men had done a week earlier. The Food Administrator appears to be the only man in the world who can, as one of his new coadjutors put it, "put you out of business and make you like and admire him for doing it."

The model of the Utah Copper Co.'s mining operation in Bingham Canyon, in preparation for some months, is now installed in the Division of Mineral Technology of the National Museum at Washington. This is one of a group of important mineral developments that are to be shown in miniature at the National Museum. The model of the Utah Copper mine was selected, says the *Evening Post*, not only to represent the opencut steam-shovel type of mining operation, but also because it represented a relatively new but important source of the essential metal, copper. The Bingham Canyon mine is one of the largest operations of this sort in the world. Where infrequent rains once washed furrows into the sage-covered slopes of the Oquirrh Mountains, a quarter-hundred hungry steam shovels are now eating their way into the heart of a mountain of copper ore—not copper ore as ordinarily seen, rich and heavy, in conspicuous seams and veins, but the new sort of copper ore, rock with such a scant scattering of copper minerals that to the ordinary eye it looks no more like ore than common granite, rock so lean in copper values that to old-line methods it remains as unprofitable to mine as common granite. Yet this new type of copper ore, developed not only at Bingham, but also as a result of its leadership at other localities in the Southwest, as well as in Mexico and Chile, is now producing more copper than the whole United States provided a decade past. Here is an object lesson of the present, a vision of the future, that all should see. Without a railroad journey to Utah, the museum visitor may obtain a panoramic view of this great mining operation. He sees a whole mountain, resting against the crest-line of a snow-clad range, stripped bare of its mantle of soil, raw and naked in its demolishment. Terrace after terrace of gray rock, 25 in all, rise step-like from the valley bottom and extend like giant stairs to the very summit, supporting nearly 50 miles of railroad. As the eye wanders up to the top, it catches here and there puffs of white vapor, accompanied by raucous noises, where ponderous steam shovels, looking tiny in the distance, are scooping out tons of copper rock and loading their charges into long trains of cars gaping for their burden. It is ugly, yet fascinating, this unwilling tribute yielded up to the wonderful effort of modern industry. This achievement of adding millions of tons of copper to the world's output is due to the vision and constructive imagination of a single mind—the dream of Daniel C. Jackling, now first vice president and managing director of the Utah Copper Company.

The Shifter's Advice

I've done my bit o' muckin',
  I've nipped and monkeyed well,
I've set most kind of timbers,
  I've hoisted at the bell.
I think I'm some machineman,
  At shiftin' rather neat,
And as for pumps and piping,
  I'm really 'ard to beat.

I call myself a miner,
  I'm happy at the name,
I sartin' think that minin'
  Is sure a real man's game.
Perhaps you're but a mucker;
  But think well of your job;
There ain't no place in such work
  For the lily-fingered snob.

Some look down on miners,
  For workin' with their 'ands,
And sneer at honest muckers,
  Not callin' the job a man's.
They make me sick as the devil,
  I want to swear and cuss;
They judge a man by what he wears,
  And not by the work he does.

But don't you care for that, my son,
  Let 'em think you're just a slob;
    But get in your round,
    And break your ground,
  And you've done a whole man's job.

B. A. PRICE.

Cost of Producing Copper

By T. D. McGrath
Auditor, Shattuck-Arizona Copper Co., Bisbee, Ariz.

Referring to the editorial in the Aug. 11 issue of the *Journal*, bearing the above heading, it would seem that the scope of the work of the *Engineering and Mining Journal* should include the advocating of uniform reports of costs, etc., by the copper-mining companies; that is, that the reports of the copper-mining companies shall be intelligible and cover all elements of expense of production or, at least, of operation. In the editorial numerous reasons were stated as to why this has not been done in the past. However, there seem to be no practical reasons why the managements should continue to "jolly" themselves, and to misinform the stockholders, investors, the tax commissioners, and the general public as to the real facts, especially in these times when such doings are working to the detriment of the companies and their stockholders.

Now that the Government is investigating this matter of the cost of copper, it would seem that the opportune time has arrived for the mining companies operating lens and fissure properties to come forth and endeavor to reach an agreement with the Government as to a reasonable and just yearly allowance for depreciation of equipment and depletion of mines. No one would expect such allowances to be exact, but such as would be fair for all concerned.

Elements of Operating Cost

Everyone who has made any serious study of the cost of mining knows that the operating-cost elements are: Labor, Supplies, Power, Repairs, Replacements, Expense and Overhead, and that all of these operating elements of expense should be charged to the cost of production; also that the other costs of production are: Administration, Depreciation of Equipment, and Depletion of Mines.

However, as a rule, the yearly reports to stockholders, issued by the large and responsible copper-mining companies, show with several exceptions, only the totals of the operating costs for each department of operation, as, for instance: The total operating costs for Development and Exploration; for Ore Extraction; Ore Transportation; Milling; Smelting; Bullion Freight and Refining; Selling; and Operating Overhead. This gives a total per pound of copper produced for operation only, and sometimes only the net total operating cost per pound is given after operation credits have been deducted. Such a cost does not include any charges for depreciation of equipment and depletion of mines, nor does it cover administrative expense, which includes corporate and income taxes, etc. Therefore it is not a production cost but an operating cost.

Taking one of the low-cost producers, the stock of which is listed on the New York Stock Exchange and which, in its annual report, shows only its operating cost, and figuring the total production to date against the initial property account gives a depletion charge of 3.25c. per pound of copper, and for Depreciation of Equipment and Administrative Expense to date about 0.5c. per lb. of copper produced.

Therefore, instead of an average total gross cost of all copper produced to date of 10c. per lb., and an average total net cost of 8.25c. after deducting credits (considering that the mine were now exhausted), the total gross cost would be 13.75c., and the total net production cost would be 12c. This would not include any interest charge on the original investment in mining property and equipment from the time of purchase to the time that the property became a paying proposition.

Average Depletion Charge

As the mineral life of every mining property has an end, the continuation of the existence of a mining company is generally maintained by accumulation and development of new properties, or the development of new processes, etc., which require expenditures that must be added to the total of the original property account, and be depreciated. Therefore, it can be stated with reasonable safety that an average depletion charge would be approximately 3c. per lb. of all copper now being produced.

The idea of mining companies classifying their dividends as "dividends earned" and "capital returned," having now received the approval of the Government, this fact should allow the lens and fissure properties to agree with the Government upon some uniform method of determining depreciation and depletion. The capital-return dividend could be determined by the amount of the depreciation of equipment and depletion of mines charged off on the books for the year, and the dividends earned could be the remainder of the net earnings set aside for dividends after the deduction of the above amount.

If it is true, as stated in the editorial, that the results of the Government "report cannot possibly be anything but a hodgepodge of fragmentary data, which will not be of value to anybody," such findings will be no reflection on the Government, but certainly will be a reflection on the efficiency of the management of the different producing copper mines, and shows a condition that certainly can be and should be remedied.

Reports Could Show Cost Elements

There is no reason why all the producing copper companies cannot easily arrange, without any great change in their present accounting and costing systems, to show in their reports total operating cost and net operating cost after deducting credits. The big low-grade companies could easily show, in addition to their total gross and net operating costs, their cost for administration, depreciation and depletion, which would give their total production cost; and if the other copper-mining companies would get together and reach some fair and definite agreement with the Government as to determining depreciation and depletion allowances they could likewise show their total production costs, and also obtain a fairer determination of net income for taxation purposes.

As shown in the July 28 issue of the *Journal*, under the heading "Average Price of Copper in 1916," the fact that out of fifteen copper companies producing electrolytic copper, which reported their average price received for copper sold, there were eight different methods used in arriving at the average price received for copper sold, would lead one to believe that the reports of operations, costs, earnings, etc., of the different producing copper companies certainly could be improved upon to the benefit of the companies themselves, their stockholders, and all others interested or concerned.

Government Fixes Coal Prices

President Wilson announced on Aug. 21 the scale of prices fixed by the Government for bituminous coal at the mine, at approximately $2 per ton of 2000 lb., or $1 a ton less than the price tentatively agreed upon at the recent conference of the Coal Production Committee and the operators. The President's statement is printed elsewhere in this issue and the prices allotted for the different districts are shown in the accompanying table.

COAL PRICES FIXED BY PRESIDENT

Per Ton of 2,000 Lb., F. O. B. Mine

	Run of Mine	Prepared Sizes	Slack or Screenings
Pennsylvania	2.00	2.25	1.75
Maryland	2.00	2.25	1.75
West Virginia	2.00	2.25	1.75
W. Virginia (N. River)	2.15	2.40	1.90
Virginia	2.00	2.25	1.75
Ohio (thick vein)	2.00	2.25	1.75
Ohio (thin vein)	2.35	2.60	2.10
Kentucky	1.95	2.20	1.70
Kentucky (Jellico)	2.40	2.65	2.15
Alabama (big seam)	1.90	2.15	1.65
Alabama (Pratt, Jaeger and Corona)	2.15	2.40	1.90
Alabama (Cahaba and Black Creek)	2.40	2.65	2.15
Tennessee (Eastern)	2.30	2.55	2.05
Tennessee (Jellico)	2.40	2.65	2.15
Indiana	1.95	2.20	1.70
Illinois	1.95	2.20	1.70
Illinois (third vein)	2.40	2.65	2.15
Arkansas	2.65	2.90	2.40
Iowa	2.70	2.95	2.45
Kansas	2.55	2.80	2.30
Missouri	2.70	2.95	2.45
Oklahoma	3.05	3.30	2.80
Texas	2.65	2.90	2.40
Colorado	2.45	2.70	2.20
Montana	2.70	2.95	2.45
New Mexico	2.40	2.65	2.15
Wyoming	2.50	2.75	2.25
Utah	2.60	2.85	2.35
Washington	3.25	3.50	3.00

The Formation of Zinc Ferrate

E. H. Hamilton, G. Murray and D. McIntosh, of the Consolidated Mining and Smelting Co., Trail, B. C., published in the July *Bulletin* of the Canadian Mining Institute a paper explaining the low solubility of zinc in some roasted blendes in dilute sulphuric acid. This solubility, as is well known, is due to the combination of zinc oxide with an oxide of iron, the compound being referred to commonly as zinc ferrite. The present author consider that it will be best to speak of the compound of zinc oxide with ferric as ferrate and with ferrous oxide as ferrite.

The authors present some interesting experimental data. A summary is as follows:

1. It is proved that zinc oxide and ferric oxide will combine readily at temperature above 1200° F., the amount of combination depending principally on the temperature and the time.

In the roasting of the ore in the Wedge furnace, however, in order to desulphurize the ore sufficiently, it is not possible to keep the temperature down to a point at which the formation of ferrate does not occur. In the upper part of the furnace, especially, it is difficult to keep the ore from becoming too hot, owing to the large amount of sulphur present, but it is possible that by decreasing the frequency of the rabbling the ore might be kept for a longer period in the furnace and subjected to a lower temperature, as the more rapid the stirring while the sulphur is burning the higher the temperature attained. In connection with this, in the case of the "Sullivan" ore as at present roasted, the maximum amount of ferrate seems to be formed, as some of the regular roast was heated to a temperature of 1500° for 5 hours and the extraction on this material was no worse than on the original.

2. Free alumina combines with zinc oxide, but when present as a silicate, the amount of combination is negligible.

3. There are four ways in which a better extraction of zinc might be obtained from an ore high in iron.

a. By roasting at a low temperature. (The remarks made at the beginning of the summary apply to this point.)

b. By eliminating the iron before roasting.

c. By the addition of some substance to the ore which would prevent the combination of the two oxides.

d. By finding some solvent for the zinc would leave the iron oxide undissolved.

St. Louis Meeting of Mining Engineers

The American Institute of Mining Engineers will hold its 115th meeting at St. Louis, Mo., on Oct. 8-13. The engineers will be guests of the St. Louis Section of the Institute, the chairman of committees including a number of well-known names. Among them are H. A. Buehler, state geologist of Missouri; F. W. DeWolf, Illinois, past president of the Association of State Geologists; James E. Castleton, A. H. Wheeler and E. F. Goltra, of St. Louis.

The program includes trips to the Joplin-Miami district, and the oil fields of Tulsa, Okla., also an inspection of the coal resources of Illinois. The meeting will be of a patriotic nature and methods of conserving the present supply and increasing the output of war minerals will receive attention.

The Institute now numbers more than 6000 members and representatives of all the principal American mining centers will be present.

Mineral Exports of Spain

The following table showing the principal exports of minerals and metals from Spain, is given in a supplement to *Commerce Reports*, dated June 22, 1917:

Substance	1915 Metric Tons	1916 Metric Tons
Copper ore	30,146	45,626
Copper precipitate	10,443	11,432
Copper bars	16,058	12,895
Iron ore	4,449,273	5,148,317
Iron pyrites	2,263,216	2,743,924
Iron and steel, manufactures of	125,838	117,667
Lead, in pigs	161,322	173,345
Quicksilver	1,121	1,276
Salt	487,567	425,022
Sphalerite or blende	11,570	59,734
Zinc, in pigs and sheets	4,581	4,856

Exports of metals and minerals for the four months ended Apr. 30 are reported by the *Revista Minera*, in metric tons:

	Metals		Ores, etc.	
	1916	1917	1916	1917
Iron	32,891	37,436	1,552,966	1,590,117
Copper	4,393	5,983	23,621	9,215
Copper precipitate	3,612	3,623	.....	.....
Lead	64,229	46,432	893	76
Zinc	1,892	1,495	43,796	18,052
Quicksilver	830	.....	.....	.....
Manganese	.....	.....	356	2,196
Pyrites	.....	.....	1,024,895	638,823

Exports of salt decreased from 133,157 tons in 1916 to 89,516 tons in 1917. Imports of coal were 536,020 tons, a decrease of 20,680 tons; of coke, 28,194 tons, a decrease of 31,636 tons.

Personal

Archibald Stark and **William R. Wright** have left England for Mexico.

Robert E. Cranston is on a two weeks' trip in Colorado and Idaho on professional work.

George A. Easley sailed from New Orleans on Aug. 17 for Panama en route to La Paz, Bolivia.

Edwin E. Chase & Son have gone to Jarbidge, Nev., and will return to Denver the last of August.

S. Harbert Hamilton, mining geologist and engineer, has moved to 701 Colonial Trust Building, Philadelphia.

Dyke V. Keedy, who has been in the Guianas in South America since January, will arrive in New York about Sept. 1.

Ellard W. Carson, manager of the Oceanic quicksilver mine, Cambria, Calif., is examining mines in northeastern Nevada.

President Rodolphe L. Agassiz, of the Calumet & Hecla, has been at Calumet inspecting the Calumet & Hecla and its subsidiaries.

Col. Robert M. Thompson has been elected a director of the Consolidated Arizona Smelting Co., in place of Alfred E. Cortis, resigned.

Ray Lacey, of the engineering staff of the Ray Consolidated Mining Co., has joined the British engineering corps and left for the front.

E. M. Rabb, superintendent of the Tom Reed mine, has returned to Oatman, Ariz., after a month's absence, during which time he visited various camps in Colorado and Arizona.

O. P. Hood has been placed in general charge of the Pittsburgh station of the Bureau of Mines. His title is chief mechanical engineer. **Lauson Stone** has been made superintendent of the station.

G. Howard Ferguson, Minister of Lands, Forests and Mines for Ontario, Can., is making an extended trip through northwestern Ontario to familiarize himself with the industrial conditions of the region.

George A. Laird, who has recently been on the editorial staff of the "Journal," has gone to the Southwest to visit the Gulf and Midcontinental fields, preparatory to going to South America to take charge of the development of an oil field.

Prof. Milo F. Ketchum, dean of the College of Engineering of the University of Colorado, was elected president of the Society for the Promotion of Engineering Education at the annual meeting of the society recently held at Washington, D. C.

C. E. Julihn, of the Bureau of Mines staff, has returned from an examination of pyrrhotite deposits in Maine and an inspection of the Canadian nickel mines. He will now inspect the nickel-cobalt properties at La Motte and Fredericktown, Missouri.

Capt. Edwin C. Eckel, E. O. R. C., has given up his practice in engineering and mining geology and has closed his office in the Munsey Building, Washington. His address for the immediate future is Headquarters, American Expeditionary Force, France.

Henry M. Payne, consulting mining engineer, will remove his office Sept. 1 from the Woolworth Building, New York, to 1203 Chamber of Commerce Building, Pittsburgh, Penn., where he will take the position of assistant to the president of the Bertha and affiliated coal companies.

Frank W. DeWolf, director of the Illinois Geological Survey, has begun his work in Washington as assistant director of the Bureau of Mines. Mr. DeWolf has been "loaned" to the Federal Government for three months by the State of Illinois, which is paying his salary and expenses.

F. G. Cottrell, chief metallurgist of the Bureau of Mines, will spend the next two months in the field. He expects to visit most of the mining-experiment stations of the Bureau and will pay special attention to metallurgical work in progress at Anaconda and in the Cœur d'Alene districts.

W. C. Thomas, consulting engineer of the Wolf Arizona Copper Co., Prescott, Ariz., is in Newark, N. J., conferring with the president on future operations of the company's property at McCabe, Ariz. His address until Sept. 25 will be c/o Hugo C. Wolf, Newark Bay Smelting & Refining Co., Newark, New Jersey.

Frank I. Ellis has recently opened offices at 2126 Farmers' Bank Building, Pittsburgh, as general contracting engineer. Mr. Ellis had charge of the designing, building and puting in operation of the new pipe mills of the Jones & Laughlin Steel Co. at Aliquippa, Penn. He was also chief engineer for 12 years of the United Engineering & Foundry Co., Pittsburgh, and later was general manager of the pipe mills of the Mark Manufacturing Co. at Zanesville, Ohio.

Dr. A. B. Macallum of Toronto University, **Dr. R. F. Ruttan** and **Dr. Frank D. Adams,** of McGill University, members of the Canadian Advisory Council of Scientific and Industrial Research, have returned from an extended tour of western Canada where they delivered many addresses and held conferences with commercial and technical organizations with the object of promoting research work. They will make a report of their investigations to the Canadian government.

Eugene Meyer, Jr., and **Charles J. Thurnauer,** composing the firm of Eugene Meyer, Jr., & Co., of New York, will dissolve partnership on Sept. 30. This firm has been prominent in the past in financing several large mining companies. Mr. Meyer, the senior partner, has been in Washington assisting the Advisory Commission of the Council of National Defense since America's entry into the war. He is a director of the Inspiration Consolidated and Utah Copper companies. Mr. Thurnauer is a French citizen and has been called to the French colors.

Obituary

Antone Joseph died at his home in Yreka, Calif., on July 24, at the age of 72. He was among the pioneers who attracted prospectors to the mining regions of northern California.

Thomas Silva died at Plymouth, Calif., on July 20, aged 93 years. He was a native of Portugal and one of the early California pioneers, the discovery of gold having brought him to Eldorado County in 1850.

Charles W. Kempton, a mining engineer, died on July 26 in the Westboro State Hospital in Massachusetts at the age of 70 years. Upon graduation from high school, he was employed in the office of J. Herbert Shedd, of Boston, where he studied engineering. Later he took a position in the engineer's office of the Proprietors of Locks and Canals at Lawrence, Mass., remaining there several years. In 1880 he opened an office in New York City as mining engineer, which he maintained until health forced him to give up his business in 1910. During this period he traveled widely. He was successful in practice and introduced various processes in silver-ore reduction in Honduras and elsewhere. He was a member of several clubs and societies, including the Engineers' Club and the American Institute of Mining Engineers.

Societies

American Institute of Mining Engineers, Utah Section, recently issued an appeal for donations of books of all kinds, including technical works, to supply the camps and cantonments of soldiers with reading matter.

American Electrochemical Society—At the meeting of the board of directors on July 27, there were elected 28 new members to the society. The next meeting of the board will be on Aug. 25. The program of the fall meeting at Pittsburgh on Oct. 3-6, will include, in addition to the symposium on electrochemical war supplies previously announced, optional excursions to various plants and institutes in Pittsburgh and vicinity. A large number of papers have been promised for this meeting.

National Safety Congress will be held at the Hotel Astor, New York, on Sept. 10-14 inclusive. The first day will be given over to special committee meetings. On Tuesday, Sept. 11, the annual meeting will take place at which officers for the ensuing year will be elected. The iron-and-steel section will hold afternoon sessions on Sept. 12, 13, 14, at which several addresses will be made, including one by L. H. Burnett, assistant to the president, Carnegie Steel Co., on "Unsettled Accident Prevention Problems in Iron and Steel Industries."

South African Institution of Engineers recently elected the following as officers for the ensuing year, the election of president being unavoidably deferred: Vice presidents, E. G. Izod and C. D. Leslie; honorary treasurer, Edward Goffe; auditor, F. W. Bompas; honorary solicitors, Hayman and Godfrey; members of council: Percy Cazalet, G. M. Clark, W. Eldon Dew, W. Ingham, J. W. Kirkland, E. J. Laschinger, S. McChesney, H. Newbery, John Orr, T. G. Otley, C. B. Patrick and J. J. Wessels. Alfred Williams has been elected to represent the Kimberley branch on the council, and the retiring president is also a member ex-officio.

United Engineering Societies Engineering Council has held two meetings since its organization on June 27, 1917, which meetings were on July 13 and July 26. The following standing committees were appointed: On public affairs, Charles Whiting Baker, G. F. Swain, Sidney J. Jennings and E. W. Rice, Jr.; on rules, J. Parke Channing, Clemens Herschel, N. A. Carle and D. S. Jacobus; on finance, B. B. Thayer, I. E. Moultrop, Calvert Townley and Alexander C. Humphreys. A war-inventory committee was created including H. W. Buck, A. M. Greene, Jr., and E. B. Kirkby to coöperate with the Naval Advisory Board and departments at Washington in presenting to engineers war problems that can be solved by invention. George J. Foran, E. B. Sturgis, A. S. McAllister and A. D. Flinn were appointed a committee to secure such information about engineers in the country as will help the war-inventions committee in its work.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Copper Leaching—Method of Treating Copper-Bearing Substances. Charles S. Bradley, New York, N. Y. (U. S. No. 1,236,046; Aug. 7, 1917.)

Cyanogen Compounds—Process of Manufacturing Cyanogen Compounds. Hans Foersterling, Herbert Philipp and Ralph Nelson Sargent, Perth Amboy, N. J., assignors to the Roessler & Hasslacher Chemical Co., New York, N. Y. (U. S. No. 1,235,887; Aug. 7, 1917.)

Digging Machine. William L. Scott, Montreal, Quebec, Canada. (U. S. No. 1,236,112; Aug. 7, 1917.)

Drilling Apparatus. George H. Gilman, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,236,371; Aug. 7, 1917.)

Drill Stem and Method of Making the Same. Robert Lee Burns, Taft, Calif. (U. S. No. 1,236,145; Aug. 7, 1917.)

Electrolysis—Apparatus for the Production of Zinc, Copper or Other Metals by Electrolysis. Marcel Perreur-Lloyd, Boulogne-sur-Seine, France, assignor to Marie Victorine Bailly. Widow Garin, Paris, France. (U. S. No. 1,235,723, 1,235,724; Aug. 7, 1917.)

Flotation of Ores. Raymond F. Bacon, Pittsburgh, Penn., assignor to Metals Research Co., New York, N. Y. (U. S. No. 1,235,954; Aug. 7, 1917.)

Rotary-Mill Construction. Milton F. Williams, St. Louis, Mo., assignor to Williams Patent Crusher and Pulverizer Co., St. Louis, Mo. (U. S. No. 1,235,868; Aug. 7, 1917.)

Titanium Oxide—Process for Obtaining Oxide of Titanium From Materials Incorporating Other Substances. Louis E. Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,235,638; Aug. 7, 1917.)

Tungsten Alloys—Process of Forming High-Percentage Tungsten Alloys. Hans Goldschmidt and Otto Weil, Essen-on-the-Ruhr, Germany, assignors to Goldschmidt Thermit Co., New York, N. Y. (U. S. No. 1,235,969; Aug. 7, 1917.)

Tungsten-Molybdenum Alloy—Alloy of Tungsten and Molybdenum. Frank A. Fahrenwald, Cleveland, Ohio, dedicated, by mesne assignments, to the Government of the United States of America and to the people of the United States of America. (U. S. No. 1,236,384; Aug. 7, 1917.)

Tungsten-Molybdenum—Process of Coating Tungsten or Molybdenum with Noble Metals. Frank A. Fahrenwald, Cleveland, Ohio, dedicated, by mesne assignments, to the Government of the United States of America and to the people of the United States of America. (U. S. No. 1,236,383; Aug. 7, 1917.)

Uniting Metals, Apparatus For. Augustus Kellogg Sloan, Brooklyn, N. Y. (U. S. No. 1,235,608; Aug. 7, 1917.)

Editorial Correspondence

SAN FRANCISCO—Aug. 15

New Oil Wells reported to the State Mining Bureau, in the week ended Aug. 4, numbered **only six and is the lowest recorded**—except one other week—in the present year. Total number of new wells since Jan. 1 is 673. There is no definite indication of general decline in the bringing in of new wells, which may be expected from a shortage of casing and other material. But the fact that the Midway-Sunset started only one new well in the week is setting some people to thinking. The number of wells in course of drilling and ready for test of water shut-off is 22, which is near the normal; and the wells being deepened or redrilled to maintain or increase production were 15, which is also about the usual number. Only five wells were abandoned in the week, making a total of 211 for the year. But abandonment does not often correspond with other activities or operation.

Loring Interests operating various gold properties including Calaveras Consolidated Syndicate at Melones, in Calaveras County, Dutch-App mine in Tuolumne County, and the Hardenberg mine in Amador County, are preparing for increased outputs owing to new installations. The Calaveras Consolidated Syndicate, W. J. Loring, manager, has installed a new electric hoist capable of hoisting from 1000-ft. depth lifting loaded 1-ton skips. The 3-stamp experimental mill has been running continuously since Apr. 1, 1917, and has treated a total of 2130 tons of ore, averaging about $3.75 per ton; the concentrates averaging $57 per ton and saving about 12% of that value. Company is now installing and expects soon to begin operation of a new 10-stamp mill equipped with 1250-lb. stamps, with capacity of 90 to 100 tons in 24 hr. Owing to the difficulty of obtaining machinery the installation of flotation plant contemplated has been held in abeyance until the mill, which will be supplied with Frue vanners, has been put in commission. By grinding the ore to 80-mesh it is expected to recover 93% of the assay value of the ore, producing a concentrate valued at $52 per ton. Experiment in the treatment of the flotation concentrate has been made and it is found that the reagents used in flotation have no injurious effect in dissolving or precipitation of the gold. The Dutch-App mine in Tuolumne County is operating with 40 men. Deepening the Dutch shaft has started and will be carried down from the 1800-ft. level to the 2200-ft. point. Levels will be opened at 2200 and 2000-ft. points. It is probable that drifts at these points will total at least 1600 ft. This is the present tentative plan. Recent development on the 2150-ft. level, reached from the winze near the boundary between the Dutch and the App mines, has been highly satisfactory. The Heslop vein proved by this development showed better than at any other point below the 1500-ft. level. In addition to the Heslop orebody, lenses of good size have been disclosed carrying a high percentage of sulphides, the assay value of the ore averaging $11.50 per ton. Driving south on the 2150 level the quartz vein lying on the east side of the Heslop orebody, and averaging 20 in. in width, contains silver ranging from a few ounces to 56 oz. per ton. Sufficient work has not been done on this silver-bearing vein to reach a definite determination as to what this particular character of ore means at this point. Plans and specifications for a new mill are under way and the management hopes to order the plant soon. It will consist of ball mills and flotation, and it is expected to be an extremely simple and effective reduction plant. The Hardenberg mine in Amador County is continuing development. The vertical main working shaft has been deepened from 1000 ft. to 1500 ft. and three levels have been opened at the 1200-, 1334-, and 1500-ft. points. The vein has been intersected at the lower level at a point between the north and south shoots and it is expected soon to reach these shoots, as the crosscuts are being driven at the rate of 80 to 100 ft. a week. There is improvement in the vein material shown between the 1200- and 1334-ft. points, being better defined at the latter level. It is expected to find a more solid condition of the vein at the 1500, and this has induced the management to continue the development program to that depth. Mr. Loring states that this conclusion is based on the well-known fact that the oreshoots in the Mother Lode vein system have been proved to lie in horizontal planes. Where the oreshoots have been proved of payable values at or near the surface, the pay is invariably extended to several hundred feet in depth, and a poor zone encountered at deeper sinking. Still the rule obtains that other oreshoots may be and are found below the horizontal poor zones. It is also true that the horizons at which the poor and the payable zones have been encountered are at practically the same depth in the several mines of the Mother Lode.

BUTTE—Aug. 21

(By Telegraph)

Labor Condition continues unsatisfactory. While new men constantly report for work at the mines, others in equally large numbers quit after working a few shifts. Due to reduced output at the mines, many men have been laid off at the smelteries. The output of copper is still less than half of normal. While several thousand miners have left the district, there are still several thousand here who refuse to return to work without a wage settlement and abolition of rustling-card system. At mass meeting last Saturday, addressed by representative Jeannette Rankin, miners declared to her in answer to question asked, that they would return to work if rustling card was done away with, and leaders of strikers so assured her personally, but in their own meeting last night many speakers among strikers denounced men who say they would return to work. These hold for flat $6 per day and no card system. They also demand investigation of safety conditions in mines. Anaconda officials have been urged by citizens to grant concessions to men regarding rustling card, but officers declare card will not be abandoned. Representative Rankin declared that if the mines are not operated by companies, they will be taken over by the Government. She urged the men and companies to get together in this crisis of the nation and show their patriotism by making mutual concessions.

BUTTE—Aug. 16

Manganese, Butte's Newest Product, is attracting increasing attention. Gold, silver, copper and zinc, produced on as large a scale as Butte has to its credit, would seem marvelous enough for any single mining district only a few square miles in extent. But it now appears that the camp is to enter on a new venture in the production of manganese ore. The existence of manganese ores in the Butte district has, of course, been known for years but the profitable exploitation of these ores in competition with the supply coming to America chiefly from India and Brazil has heretofore been impossible. With the curtailment of this supply due to the war and the market price as high as $1.20 per unit for high-grade manganese ore, buyers of such ore have been in Butte for some time making arrangements for the purchase of manganese ores in quantity, offering attractive inducements to mine owners and prospectors who are in a position to furnish such ores. Under this stimulus, the most available deposits of manganese ore in the Butte camp are now being exploited by owners and leasers.

Hayden-Stone Interests have taken over another group of zinc and silver mines in the Butte district. The new group consists of nine claims, situated in the southwestern section of the district, adjoining the Britannia mine, which is being developed by W. L. Creden. Included in the new group is the Germania mine, an old-time silver producer, but which has been idle ever since silver was demonetized. When the Germania was worked, the zinc ore in the property had no value, in fact was a detriment to the recovery of the other minerals. Surface developments on the property also show the presence of manganese ores, which are just now in great demand. The Germania has a shaft 400 ft. deep, with extensive drifts run from the 100-, 200- and 300-ft. levels. Over 1000 ft. of drifts were made in the early days. There are several other shafts in the group of nine claims. The Germania workings are full of water and it will probably take two months to get the water out and prepare for development work. Old records of the Germania show that it had a large vein of ore running high in silver and zinc. The property belonged to James A. Murray, a private banker, who has owned much mining property in the Butte district, but who has never developed any mine. The mines have been taken over by J. L. Bruce, as trustee. Bruce is general manager of the Butte & Superior, and it is probable that a new company will be formed to carry on operations on the new property as soon as the preliminary development work is completed. The southwestern section of the Butte district is coming to the front wonderfully, as many of the old properties there are found to be rich in silver, zinc and manganese. In this section are situated the Emma mine of the Butte Copper and Zinc, the Ophir of the Butte-Detroit company, the Britannia of the Creden syndicate, and Senator W. A. Clark has just started work on some of his property in that section, included in the old Travonia group.

DENVER—Aug. 16

Gold Dredging in Lake County continues to be profitable, though the only operation is that of the Derry Ranch Gold Dredging Co. It happened also that this was the only mining operation in the Leadville region that continued without interruption during the recent strike. The dredge started this year on Apr. 22—about one month later than in 1916—and has been recovering about $22,000 per month in gold and paying a monthly dividend of 10%. This is only one example of latent resources of Colorado that have lain idle for many years. Engineers passed by this property almost daily for 40 years.

SALT LAKE CITY—Aug. 17

Adjudication of Water Rights is sought between the state water-rights commission and Federal officials in an effort to perfect a system of coöperation. A bill is to be drafted, covering the subject for presentation to and passage by the next legislature. A meeting was held recently to consider the question Aug. 8, at which Governor Bamberger, Harden Bennion, secretary of state, Dr. Samuel Fortier, chief of Federal irrigation investigation, F. G. Harden, Federal irrigation economist, L. M. Winsor, irrigation engineer for the extension division of the Agricultural College of Utah, Prof. O. W. Israelsen in charge of irrigation work at the Agricultural College were present.

Workmen's Compensation Act—which went into force Aug. 1—has caused the Scranton Leasing Co. of Tintic to bring before the courts the question as to whether employers may insure in participating companies or at a rate lower than that fixed by the State Industrial Commission for insurance with the state. This company, employing 30 men, has applied for a writ of mandamus in the supreme court to compel the industrial commission to reinstate a policy taken out by it with the Interstate Casualty Co. of Birmingham, Ala., and rejected by the commission on the grounds that the rate (fixed by the commission) is $5.59 per $100 of employees' payroll and that the policy provides for a rate of $5 per $100 of employees' payroll. Also the policy—as indicated above—is a participating one, and according to the ruling of the commission not allowed. Interesting questions are involved, among them the method employed by the industrial commission in arriving at the rate of insurance, etc.

Transport of Carbon County Coal Is Approaching normal tonnage, as the work of repair to the Scofield branch of the Denver Rio Grande R.R., after the heavy damage from the Mammoth reservoir flood, progresses. The area flooded comprises over 20 miles, and in 8 miles of this the line was entirely destroyed. The railroad expects to have an improved double-track system operating smoothly in the near future as well as all the rolling stock needed for the output of the Carbon County coal mines. The railroad will be ready to turn over its

second track between Thistle and Helper to the Utah Coal Route by Sept. 1, it is stated. Congestion at the Baldwin Locomotive Works—owing to special demand for work made by the Government—may delay the delivery of locomotives to the new company. The date set by contract for the taking over of the Denver & Rio Grande second track by the Utah Coal Route is Nov. 1, and whether this company will be able to begin operation before that date is of course dependent in a large measure upon how soon motive power will be available.

WALLACE, IDAHO—Aug. 18

Attempt to Unionize the mines and mills of the district by the wide distribution of handbills, which is evidently the first move in the campaign, has aroused considerable apprehension among the mining companies. No name either of individual or organization appears on the bills, but it is known that a special representative and organizer of the International Union of Mine, Mill and Smelter workers is in the district, coming here from Utah, and it is assumed that it is through him that the campaign is to be inaugurated. As is generally known, this organization is the Western Federation of Miners under a new name, but under the same leadership, Charles H. Moyer being president. The handbill reads as follows: "MEN WANTED: The United States is in war for the purpose of making the world safe for democracy. Congress has established universal service and conscription. The labor movement wants universal service and volunteers to assist in maintaining democracy in the United States. Changing industrial conditions make it imperative that the workers unite at once to protect their interests. Don't you think it is time, Mr. Miner of the Cœur d'Alenes, that you join the union and begin to do your bit; time to forget that personal grievance and look ahead instead of backward? A campaign for the organization of the district is under way. By Labor Day we want a 100% organization. We want your assistance. Meetings this week at Gem, Mullan, Burke, Wallace and Nine Mile. Boost for 3500 members in the Cœur d'Alenes by Nov. 1." Following the blowing up of the Bunker Hill & Sullivan mill in 1899 by members of the Western Federation of Miners, that organization was driven from the district first by the rigid regulations adopted by the military authorities and for years afterward by the maintenance of an employment office in this city which exercised close discrimination in the selection of men for the mines and mills. However, the local unions retained their charters and skeleton organizations, but they were thoroughly discredited and too weak numerically to make their influence felt. These unions possess some traits which it would be well for the mining companies to emulate. They remain "on the job" whether in victory or defeat. If victorious, they crowd their advantage to the limit; if defeated, they watch and wait, knowing by experience that the mining companies will relax their vigilance and give them the opening through which they may recover what was lost. The employment office was an effectual barrier to the old Federation gang. As years past following the trouble of 1899, one after another of the mining companies withdrew from the employment office until the first of this year, when the last one returned to direct employment and the office passed out of existence. From that date the union showed increased vitality and has been steadily gaining strength. Presuming upon the forgetfulness of the people, the Western Federation has seized upon the I. W. W. menace, denouncing that lawless and treasonable organization and making a patriotic pose in support of law and order. What the mining companies will do to meet the issue that is now about to be thrust upon them in this campaign to restore the power of the old union doth not yet appear. Of late they as well as other citizens have been busily preparing to suppress the I. W. W. propaganda in this district, but what's the use if the bars are to remain down for the free entrance of the Western Federation, which, so far as methods are concerned, differs from the I. W. W. only in name?

JOPLIN, MO.—Aug. 18

Mining Costs will be investigated by a skilled accountant in the sheet-ground field by order of the Council of National Defense. The first man on the job is an expert from Kansas City, who has announced that the Government has no intention of making a probe, but that he is authorized to take the operator's figures.

Several Important Sales were recorded here during the last week. The largest was one wherein F. C. Wallower and P. E. Tabor of Joplin were reported as having paid $300,000 for the Golden Rod mill and lease of the Nichols-Williams Zinc Co. of Miami, Okla. Mr. Tabor says the deal has been closed, but Mr. Wallower says it has not been finally closed, but pending. The Chicago-Miami Mining Co. purchased the lease of the Producers Mining Co., situated just south of the Broom Factory tract and northwest of Picher, for a consideration given to the public as $100,000. The buying company has purchased the Franklin concentrating plant south of Carterville, Mo., a sheet-ground mill of 500 tons capacity, and will move it to the lease. E. L. Bucy of Bartlesville, Okla., and P. L. Grace, of Altus, Okla., yesterday purchased the lease of the Big Ben Mining Co. on the L. C. Church land just south of Century, Okla., for $75,000. The Big Ben Company was made up of investors from the State of Washington. A number of drill holes and a shaft into ore are all the developments on the property. E. A. Landreth of Joplin sold a lease on the Cooper estate, west of Baxter, to the owners of the Bethel and Croesus mines in this camp, for $40,000. S. A. Grantham, of Baxter and E. J. Pratt, of Webb City, sold a lease on the Eli Kane land, west of Baxter, to Kansas City investors for $10,000, and retained a substantial royalty.

AJO, ARIZ.—AUG. 18

New Cornelia Leaching Plant now has been running a month and a half, giving full demonstration of the success of the process. The copper produced is being shipped directly to the Raritan works at Perth Amboy, N. J., to be melted into wire bars, the same as electrolytic cathode copper. Additional value attaches to this in view of the fact that copper refineries latterly have been crowded to the limit and there is consideration also of an interest saving of at least 60 days, the time required to realize upon ordinary bessemer copper from the Southwest. It is shipped in cathodes of 165 lb., a limit set merely for ease in handling, as the growth in the sulphuric acid bath is at the rate of 10 lb. a day. Production has been about 75,000 lb. a day. The extraction percentage from the ore has averaged 81.6%. The ore, estimated at 1.5% copper, also has been better than expected, averaging 1.7. Production costs are expected to aggregate about 8c. a pound, among the lowest in the Southwest. It is reported that the construction of a new 5000-ton concentrator, with flotation annex, has been decided upon for the treatment of sulphide ore; also that a reverberatory smelting plant will be built to treat the concentrates in the district, this being deemed more economical than shipping to the Calumet & Arizona smeltery at Douglas.

WASHINGTON—Aug. 17

Recovery of Sulphur from sulphur dioxide in waste smelting gases can be carried out successfully in some localities by the wet Thiogen process, it is announced by A. E. Wells in a report just issued by the Bureau of Mines. Sulphur can be produced in this manner at a cost of $12 a ton, the report states. The process is described as follows: "In carrying out the Thiogen process the gases are first cooled and cleared of all dust and fumes. They are passed through an absorption tower in which the sulphur dioxide is absorbed in water or mother liquor. To the solution of sulphur dioxide is added powdered barium sulphide, when there is precipitated barium sulphite, thiosulphite and sulphur; the precipitate is settled and the mother liquor is returned to the absorption tower. The settled precipitate is then filtered and dried. The elemental sulphur and one-half the sulphur from the thiosulphite is distilled and the sulphur vapors condensed. The residue, consisting of barium sulphite and sulphate is then reduced to sulphide, which is returned to the operation as a precipitate."

The Mining News

ALASKA

PLATINUM DISCOVERY is reported by Dr. Herschel C. Parker along Kahiltna River. Platinum has been previously reported from several sections in Alaska but no important commercial production has been developed to date.

ALASKA COPPER SHIPMENTS to United States for July amounted to 13,281 gross tons, containing 8,116,538 lb. copper.

ARIZONA

Greenlee County

ARIZONA COPPER CO. (Clifton)—June production of copper was 4,800,000 lb.

CONSOLIDATED MINING (Tucson)—Suit brought by William Bayly of Los Angeles against the Consolidated Mining Co., W. R. Ramsdell and J. D. Dotson for recovery of notes amounting to $67,500 settled in favor of plaintiff. Defendants immediately appealed. Involves ownership of 10,000 shares of Compania Minero de Casados, S. A., a property located in Jalisco, Mexico.

Pinal County

GILA DEVELOPMENT (Kelvin)—Pending arrival of larger pumping unit sinking in main shaft suspended and crosscut being driven to vein from point 100 ft. below the collar. Some drifting will be done on this level but planned to resume sinking shortly.

FORTUNA (Superior)—Situated near Magma mine, five miles north of Superior which is nearest railroad station. Principal development by shaft, 430 ft. deep on main north and south vein, and tunnel on largest east and west vein. Recently equipped with air drills and driving 750-ft. tunnel to intersect principal east and west vein; now in 450 ft. According to telegraphic report, 2-ft. streak high-grade ore encountered in tunnel. Expects to begin shipping immediately.

CALIFORNIA

Calaveras County

COMET (Railroad Flat)—Ore vein disclosed 20 in. wide followed for distance of 35 ft. The 10-stamp mill running on ore from old ledge and reported to be recovering $15 a ton. Joseph King, superintendent.

LARKIN (Diamond Springs)—Brush fire starting in vicinity of Griffith mine almost destroyed mine and mill buildings. Fences, timber and vegetation destroyed in neighborhood. Griffith mine saved by change in wind to the southeast, driving fire into Diamond Springs.

FIFTEEN CHROME CLAIMS in Crescent City district have been located on line between Low Divide and North Fork of Smith River by George Hyde.

LOW DIVIDE (Crescent City)—Chrome ore being shipped to Crescent City, then via steamer to San Francisco; 3000 tons ready for shipping. The 88 tons of chrome on steamer "Del Norte" when beached was from this property. E. P. Moore, Berkeley, manager.

Kern County

TUNGSTEN development reported at Glennville; also antimony. Glennville is situated between Poso and Cedar Creeks about six miles west of Greenhorn Mountains and about 40 miles northeast of Bakersfield. Stated that development of tungsten and antimony ores progressing with permanent prospects. Ores said to

be ordinary grade but extensive in possible tonnage of profitable extraction.

Placer County

CHROME ORE spotted with gold reported by Garrison Brothers at Bath in Forest Hill district. They have taken out several tons of this ore, running high in gold. Association of gold-bearing ore with chrome is common in this and other districts and also chrome ore frequently discloses gold content. First report of occurrence of free gold in chrome ore probably in the state. Found in serpentine belt, carrying no quartz.

BEAR RIVER WATER & POWER CO. (Auburn)—Permit to issue 9997 shares of capital stock to J. W. Morgan, J. L. Rollins and Daniel Kirby, trustees, in exchange for Monte Rio placer claim situated in Bear River above the dam of the Bear River and Auburn ditch. Water will be diverted through open cut and tunnel. If prospecting warrants the ground may be worked by dredging.

Plumas County

IRON DIKE (Taylorsville) — Reported U. S. S. R. & M. Co. abandoned development upon refusal of owners to grant extension of time for further exploration and development.

ENGELS COPPER (Engelmine)—William E. Roeder, killed July 10 by fall from top of forms used in constructing tube-mill foundation. Distance was only 5 ft., but his head struck concrete foundation and neck was broken.

DIVING APPARATUS will be used by San Francisco and Quincy men for recovery of gold from bed of Feather River above Quincy. This method has been used at different times on the Bear and American Rivers, also on the Sacramento River near Redding.

GRUSS MINING CO. (San Francisco)—Secured permit to issue 510,000 shares capital stock, par value 25c., to owners of Genesee and Mohawk mining claims in Genesee district. Also permitted to sell 200,000 shares for cash to be used in equipment and development.

PILOT (Genesee)—Six-foot vein disclosed by J. W. and A. P. Goodhue of Quincy. Reported that returns from 10-ton sample sent to Utah showed favorable content of copper, gold and silver. Tunnel being driven 550 ft. to tap ledge at 280-ft. vertical depth. Property adjoins Gruss mine on north and Five Bears on south.

Shasta County

AFTERTHOUGHT (Ingot)—Trial run of new reduction plant expected about Sept. 1. Completion of plant delayed by tardy shipments of machinery and material from East.

SHARP GROUP (Buckeye)—William T. Morgan of Denver optioned this property, situated near Churntown. Claims are Copper King, Copper Queen, Hilltop, Jarvis. Development will begin on or before Sept. 1. Price said to be $15,000.

MIDAS (Knob) — Unwatering shaft in progress. Two gas engines installed for generating electricity when water supply fails, electric power plant having been installed to replace the old steam plant. Improvements in the mill contemplated.

BULLY HILL (Winthrop)—Reported 50 tons of high-grade ore a day being shipped to Mammoth smeltery at Kennett. Also that operators contemplate installation of flotation plant if ore is found amenable to this treatment. The 900-ft. shaft on the Rising Star has been unwatered. The ores of Bully Hill contain silver and gold in addition to the copper and zinc.

COLORADO

Boulder County

ROYAL GEM MINING CO. (Boulder)—This New Orleans company preparing to equip 41-acre gold-silver-copper property for early production. William B. Baker, engineer. Head office, 409 Godchaux Building, New Orleans, Louisiana.

Clear Creek County

ONONDEGA (Georgetown) — Capital raise completed and regular shipments made. Crew will be increased and larger production made.

VIRGINIA GULCH MINES, east of Idaho Springs, showing considerable activity. Mines working are Trio Tunnel, Two Brothers, Windsor Castle and Lake; latter worked by lessees through Big Five Tunnel.

Dolores County

ALUNITE DEPOSIT, near Rico, acquired recently by Pueblo, Colo., men. Tests being made to determine possibility of extracting potash economically.

Gilpin County

FAIRFIELD (Russell Gulch)—Old lead producer being reopened.

HAMPTON (Central City) — Shipping good-grade gold-lead ore.

IRON (Central City)—Stated will be unwatered and reopened. Part of Pewabic property.

MOHAWK (Central City)—Being worked by Big Six Leasing Co. Tunnel will be driven further on vein.

WOOD (Russell Gulch) — Unwatering progressing rapidly. Noted producer of pitchblende ore in past.

RODERICK DHU (Central City)—Will be reopened. Mine located on famous "Patch," of Quartz Hill, a highly mineralized area, and large producer of good-grade gold ore in past.

SARATOGA (Central City) — Lessees treating dump ore in milling plant. Operations possible for only few months in spring and summer on account of water supply. Will take several years to treat entire tonnage of dumps.

Hinsdale County

VARDEN BELLE (Lake City)—Sold recently to Denver men. Vein opened by 200 ft. crosscut tunnel and 300 ft.-drift, shows good-grade ore. Extensive development work planned.

GOLDEN FLEECE (Lake City)—Flotation machines being installed; plant will be ready for operation in a short time. Much ore blocked out in mine. Was famous high-grade gold producer of Lake City's early days.

Lake County

HIGHLAND MARY (Leadville)—Lessees have reopened this old-time gold-silver producer in Stray Horse Gulch, and making regular shipments of good-grade ore.

Mesa County

CARNOTITE ORE being shipped from Gateway. Hauled by wagons to Whitewater, shipping point on Denver & Rio Grande railroad.

IDAHO

Shoshone County

NATIONAL (Mullan) — Since cutting vein on 1500-ft. level few weeks ago drifts have been run both east and west about 40 ft., ore in east drift showing decided improvement and the west holding its own. Repairs to tramway completed and bins at mill, a mile away, will be filled preparatory to starting up about Sept. 1. Large amount low grade ore available.

HIGHLAND-SURPRISE (Kellogg)—Construction soon to commence on aerial tramway, about two miles long, to connect mill with railroad up Pine Creek. Now shipping a carload a day, hauling 10 miles. Shaft from main tunnel now down 125 ft., following the vein. Ore, lead and zinc, is of better grade than in upper workings. Large settling tank recently added to mill.

NABOB CONSOLIDATED (Kellogg)—Leased the Federal's mammoth mill at Wallace. Now shipping ore from Denver claim, hauling to railroad. Will use leased mill when Pine Creek railroad is operating, until completion of new mill at mine. Considerable high-grade lead and zinc ore being shipped now. Shoot has been proved 500 ft. in length and from 1 to 6 ft. wide.

REX CONSOLIDATED (Wallace)—Fire in mine resulted in loss of several thousand tons ore in stope, and of 40,000-ft. stump pile which was first fired by I. W. W.'s, flames having been drawn down intake shaft burning out all timbering and then extending into stope. Mill running at half capacity—100 tons per day—due to lack of ore. Expect to have full supply shortly.

ILLINOIS

ALUNITE CO. OF AMERICA (East St. Louis)—This new Kansas City, Mo., company has purchased 40-acre tract in Washington Park district, near Caseyville, for plant to treat western alunite for potash.

MICHIGAN

Copper

HANCOCK (Hancock) — July production, 323,000 lb. copper, as against 393,000 for June; decrease due to labor shortage.

BEAR LAKE "POOL" (Hancock)—Reopening old pit; St. Clair Drilling Co. starting hole for unidentified conglomerate.

WINONA (Winona)—Has stopped testing quality of rock underground by diamond drilling; some good stretches found in 2500 ft. drilled.

COPPER RANGE (Painesdale)—Working three diamond drills on optioned tract south of Globe; overburden over 400 ft.; one good lode indicated so far.

CALUMET & HECLA (Calumet)—Improving considerably in daily tonnage, being 9040, with Tamarack's rock, about 9850 tons.

NEW ARCADIAN (Houghton)—Crosscutting at 1500-ft. level west for old Arcadian lode found good. No. 2 shaft down 120 feet.

WAUKULLA (Houghton)—Owner W. J. Landon, banker of Winona, Minn., died July 28; his son, F. C. Landon, administrator, will sell or give option.

WOLVERINE (Kearsarge)—July yield lowest of the year, being 14.12 lb. per ton; from 27,557 tons obtained, 363,888 lb. of copper, in January, 33,170 tons and 501,478 lb. of copper.

MOHAWK (Mohawk)—Highest yield in July for sometime, 23.27 lb. a ton, but lowest tonnage and production, 41,678 tons ore and 970,538 lb. copper, as against January, 60,478 tons, and 1,195,940 pounds.

OSCEOLA (Osceola)—Maintaining labor supply; will decline in tonnage slightly, as N. Kearsarge No. 4 electric motor will replace shaft-house engine. Farrell crusher installed.

NEW BALTIC (Houghton)—Drifting on 250-ft. level of New Arcadian and crosscutting east and west; the western seeking No. 8 conglomerate, found well mineralized rock in some places.

MINNESOTA

Cuyuna Range

STRIKE OF MINERS called by I. W. W. Aug. 6, still on. Demands presented to mine operators refused. Feigh, Merritt, Mangan Nos. 1 and 2 mines idle. Sultana, Cuyuna Mille Lacs, Cuyuna-Duluth, Armour No. 2, Meachem and Croft working 50% normal force. Striking miners practically all Finnish. Austrian miners remained at work. No disorder or demonstrations.

HOCH (Manganese)—Installing new electric and gasolene pumps.

KLONDIKE MINING CO. (Superior)—Operating diamond drill on SW¼, SE¼, Sec. 32-48-29.

CUYUNA MILLE LACS (Ironton)—Shipped, with Sultana, stockpiles of manganiferous ore aggregating 67,860 tons.

Mesabi Range

MADRID MINE (Virginia)—Caves over the mined portion of this orebody ordered filled by city council, are to be filled with dirt from the Oliver company's stripping.

LEETONIA (Carson Lake)—One shovel working in the pit and one in the stockpile loading ore. Also shipping directly from the mine pocket. Jones & Laughlin operation.

MADEIRA (Hibbing)—This mine, a state lease operated by local capital is tramming out a few pillars of high-grade ore left by former leasers. This ore is being stocked close to the Pool pit. R. Remer, superintendent.

BENNETT (Keewatin) — Butler Bros. have one 350-ton shovel stripping, one lighter shovel engaged in cleaning, and two in loading ore. Contractors Challberg & Baum, of Grand Rapids, are well along with their contracts on the new mine buildings. Property of Pickands Mather Co.; R. Downing, superintendent.

MESABI RANGE PRODUCTION practically normal. The specter of labor trouble which hung over this district for the last two weeks has vanished. It is understood that all the men at the mines around Gilbert and Biwabik are returning to work and that in all parts of the range the work of getting out ore is now going on unobstructed.

HELMAR MINE (Buhl)—Swallow Hopkins Lumber Co. property. Has finished incline shaft down side of pit and will abandon former method of loading directly by steam shovel into large cars; will load into small dump cars which will be trammed to shaft, then hoisted to surface and dumped into railroad cars. This saves a hard pull over steep grades from bottom of pit to ore yards.

MISSOURI

Joplin District

NIANGUA (Miami, Okla.)—Building 250-ton mill on lease west of Picher, Okla. Expect to complete by Oct. 15.

BILLIKEN (St. Louis, Okla.)—About to start construction on 350-ton mill. Lease northeast of St. Louis proved by 17 drill holes, all showing good ore.

L. J. STEVENSON (Neck City)—With associates will reopen Cockelburr mine, which was good producer few years ago. Mill to be overhauled.

LIVE WIRE (Joplin)—Employing double shift in sinking new shaft on Renzenhausen land, southwest of Joplin in new territory. Drilling shows ore at 140 ft. May open new field.

PLAYTER BROS. (Joplin)—Sinking two shafts on lease about one mile west of Blue Mound, west of Baxter, Kan. Have put down 35 drill holes on 135-acre tract, most of them showing good ore.

PICHER LEAD (Joplin)—Has about completed framework for new mill to be known as Goodeagle, situated west of Tar River, Okla. Is seventh of company's mills in Oklahoma field.

TENNESSEE (Zincite)—Has become one of best soft-ground producers in local field, making three carloads weekly of high-grade blende concentrates. Situated on old Yellow Jacket lease which was big producer few years ago. R. H. Allen, Joplin, manager.

GEORGE T. STILLMAN (Joplin)—An oil man of Oklahoma recently took lease on tract at Waco and first drill hole is one of best put down in that section. For 20 ft., average assay of cuttings was over 25% blende. More drilling will be done at once.

MONTANA

Jefferson County

OLD GREGORY MINE slag dump being hauled to Wickes for shipment to smeltery.

NEW STRIKE made on Alta Mountain, Corbin district. Silver-lead vein 6 ft. wide.

DAN TUCKER (Clancy)—Incorporated for $150,000, and will be worked by Lackie company.

MT. WASHINGTON (Wickes)—This mine shipping. Ore 14 ft. wide encountered in tunnel at 700-ft. depth. Silver-lead ore.

Lewis and Clark County

PEERLESS QUEEN (Rimini)—Work resumed Aug. 8. Opened to 300 feet.

NILE (Marysville)—High-grade galena ore to smeltery from this mine in Towsley gulch.

HELENA MINE (Helena)—Three carloads ore shipped from 300-ft. level. New 75-hp. boiler in place.

CRUSE CONSOLIDATED (Helena)—Drifting in ore at 150-ft. level and crosscutting.

SCRATCH GRAVEL GOLD (Helena)—Two carloads of ore sent to smeltery during recent week. Returns from first car, net, $3100 gold.

PORPHYRY DIKE (Rimini)—Crew at work remodeling mill for treating the low-grade ore. Tails to be pumped over ridge to Boulder watershed.

BACHELOR (Stemple)—Mine and mill closed on account of alleged excessive mining cost. Developed by 1400-ft. crosscut tunnel. Lane mill. Free gold.

Park County

JARDINE GOLD MINING AND MILLING CO. (Jardine)—Several old producers, six miles from Gardiner, Mont., being exploited for tungsten ores, under management of H. C. Bacorn of Butte. Shipment recently made. Equipped with stamp mill, cyanide and hydro-electric power plant, Company owns townsite of Jardine with electric light plant and water-works and recently purchased adjoining property of Bear Gulch Placer Mining Co. together with important water rights.

NEBRASKA

ALLIANCE POTASH CO. (Antioch)—Has purchased 40-acre tract for plant to extract potash from bitterns near Alliance, where citizens are endeavoring to induce company to erect plant.

NEVADA

Esmeralda County

ATLANTA (Goldfield)—Ore coming from northern workings on 1750-ft. level of good grade. Development progressing and adding to reserves of flotation ore.

JUMBO JUNIOR (Goldfield)—Good grade ore encountered in winze sunk from north drift on 880-ft. level in territory leased from Reorganized Kewanas Co. Ore being broken for shipment to smeltery.

Humboldt County

HONEY BEE (Winnemucca)—Development work to be started shortly on this property near Willard. Equipment installed to sink shaft from 50 to 250-ft. level and contract let. Ore previously shipped from shallow shaft. T. J. D. Salter interested; also Charles S. Sprague of Goldfield.

Nye County

TONOPAH ORE PRODUCTION for week ended Aug. 11 was 8543 tons valued at $153,774. Producers were: Tonopah Belmont, 2634 tons; Tonopah Mining, 1450 tons; Tonopah Extension, 2380 tons; Jim Butler, 800 tons; West End, 829 tons; Rescue, 255 tons; Monarch Pittsburg, 32 tons; Midway, 78 tons; Montana, 30 tons, Cash Boy, 55 tons.

OREGON

Josephine County

ROBERT GRIMMETT, who located chrome deposits near Holland is now shipping to Grants Pass.

CHROME DEPOSITS near Wolf Creek are being developed by Dr. J. F. Reddy, of Grants Pass.

TEXAS

Llano County

WAKEFIELD IRON AND COAL LAND CO. (Llano)—Developing graphite deposit situated across Llano River. Shafts 20 to 55 ft. deep, have indicated eight or nine lenses, 50 to 130 ft. wide. Series of test pits now being put down across formation 1500 ft. wide; graphite also found beyond this width. Ceylon E. Lyman, 813 Lumber Exchange, Minneapolis, Minn., president.

UTAH

Beaver County

MILFORD COPPER (Milford)—Shipping regularly from small portion of property, and ore reserves increasing. Development on large scale planned for other parts of property, looking to development of good bodies of milling ore. Purchase of another property in contemplation.

Grand County

FORTUNA INDEPENDENCE MINES (Green River)—New gold property reported with considerable ore in sight; 85 miles from Green River. Five stamp mill being built. Opened to 100-ft. level.

Juab County

MAMMOTH (Mammoth)—During first half of 1917, shipped 399 cars of ore estimated at 20,000 tons.

VICTORIA (Eureka)—Property acquired not long ago by Eagle & Blue Bell, indebtedness of about $45,000 cleared, and $50,000 paid in dividends, with $50,000 in treasury. Property operated through Eagle & Blue Bell at low cost. July earnings said to have amounted to $35,000.

Salt Lake County

EMMA CONSOLIDATED (Alta)—Stated to be shipping about 70 tons a day, and to be able to increase this rate considerably. Wagons and trucks being used for hauling.

UTAH APEX (Bingham)—Receipts for quarter ended May 31, were $174,256, expenses, $125,622, and net earnings, $48,634. Directors have authorized $50,000 disbursement for Liberty bonds, since that date. Cash on hand, May 31, was $351,220, with $100,000 American and foreign bonds in addition.

MICHIGAN-UTAH (Alta)—After embargo of week by smelters, ore accumulation being brought down canyon as rapidly as possible—about 80 tons a day. Development continues in the Copper Prince tunnel, from which a shipment of iron ore was made recently, valued at about $10 a ton.

SHIPMENTS FROM ALTA being increased, as railroad from Wasatch to Midvale is improving its trackage. On July 29, there were hauled nine cars—seven from Michigan-Utah, one from Emma Consolidated, and one from the South Hecla. Railroad expects to haul from now on 8 to 10 cars daily. Michigan Utah expects to send out 100 to 150 tons daily, using its aërial tramway, teams, and the railroad. The Sells is said to have 150 to 200 tons awaiting shipment. South Hecla shipping at the rate of car a day, and expects to double output soon.

Tooele County

GARRISON MONSTER (Gold Hill)—This lead-silver mine, eight miles north of Gold Hill, employing 11 men. Has 20 carloads of ore on dump and expects to begin regular shipments shortly. J. P. Gardner, Salt Lake City, interested.

WISCONSIN

Zinc-Lead District

VINEGAR HILL ZINC (Platteville)—New Jefferson mill at Hazel Green completed and plans made to open and equip the New Rundell at Livingston.

MUD RANGE (Potosi)—H. S. Klein and associates of Milwaukee completed 2-jig mill at Potosi.

LAURENCE MINES CO. (Dubuque, Ia.)—Holzer tract of 400 acres, four miles southwest of Platteville, under development and zinc ore found in first drill hole.

UTT-THORNE (Platteville)—The old Harris mine, at Mineral Point, again producing under new management.

CANADA

British Columbia

TRUE FISSURE MINING AND MILLING (Trout Lake)—Development work last year obtained good results. Purchased property in 1906, but did little until August, 1916, when cuts were made along outcrop exposing ore for about 800 ft. in each instance. Now driving two tunnels, one to the North at 400-ft. and to south at 200-ft. depth below outcrop. South drift after cutting vein continued along hanging wall side for 165 ft. with four intermediate cuts disclosing about 12 ft. high-grade concentrating ore of complex nature. Average samples show following: Silver, 19.6 oz.; gold, 0.08 oz.; copper, 1.1%; zinc, 9%; Iron, 23%. Vein is banded, metals occurring in bands 2 in. to 2 ft. wide. Ore, hand sorted from these cuts and sacked for shipment. Also have considerable tonnage lower grade ore and expect to erect mill. A. L. Houston, resident director.

Manitoba

REX (Herb Lake)—One shaft down 117 ft. and drifting commenced at 110-ft. level, vein averaging 49 in. wide. A 40-ton mill and other equipment ordered.

MANDY (Schist Lake)—Modern mining machinery has been installed. Large power house nearly completed. Shaft down 90 ft. and drifting will be started when the 100-ft. level is reached. It is proposed to take out ore again during the winter for shipment on the opening of navigation.

Ontario

UNITED KIRKLAND—This company recently organized, acquired Ellis-Dodge claims southwest of Teck Hughes, and will begin development.

McKINLEY-DARRAGH (Cobalt)—Building for flotation plant completed, machinery being installed and expected to be in operation within a few weeks, giving total capacity of 500 tons per day. Improvements made in hoisting equipment for handling increased tonnage. Owing to increased price of silver, several bodies of milling rock, not profitable two years ago, may now be exploited.

WASAPIKA GOLD MINES, LTD. (West Shining Tree, via Ruel)—Has group of Ribble claims in Sudbury division. Vein uncovered for 2000 ft., average width of 4 ft. of quartz. Employing 10 miners in sinking double-compartment shaft to 200-ft. point and will develop to that depth. Decided to erect small steam plant on property to be completed in February, to facilitate shaft sinking. George R. Rogers, president and manager. R. S. Manwell, foreman. Head office, 904-905 Bank of Hamilton Building, Toronto.

KIRKLAND LAKE GOLD MINING (Kirkland Lake)—First annual report for year ended May 31, by F. L. Culver, president, shows development work amounted to 3072 ft., divided as follows: Drifting, 1534 ft.; crosscutting, 796 ft.; station cutting, 215; sinking, 526. No stoping done on property, ore extracted being from development work only. Estimated to have on surface 6000 tons, $10 ore. Intend to erect 150-ton mill near new shaft to be sunk. Present shaft near eastern boundary, and developed tonnage is toward the west making necessary new shaft. All work financed by Beaver Consolidated Mines, Ltd., of Cobalt.

MEXICO

ESTABLISHING A MINING CHAMBER is the purpose of an announcement sent out by Attorney Alberto Terrones Benitez, Apartado 156, Durango, to the mining communities of the State of Durango. Mine owners and managers of registered properties are invited to attend personally or to be represented at the first general assembly to be held Sept. 15, at 9 a.m., at the "Salon de Actos" of the "Instituto Juarez." The following information is requested from all mine operators: Name of proprietor; name of properties, exact location, number of dependencies, metals exploited; state if reduction works or foundry established; possessions being exploited and virgin properties; name of representative in the assembly (a signed letter giving such power certified by a public official and two witnesses will be sufficient).

FRANCE

LARGEST IRON BLAST FURNACES in France just started near Caen, Department of Calvados, according to cablegrams of Ang. 20. German interests formerly controlled holdings and were preparing to erect reduction plants, including steel mills.

BELGIAN CONGO

UNION MINIERE DU HAUT KATANGA (Elizabethville)—July copper production was 4,850,120 pounds.

AFRICA

GOLD OUTPUT of West Africa in June was 27,517 oz. For half-year ended June 30, total was 181,720 oz. in 1917, a decrease of 17,261 oz. from last year.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

Aug.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Aug.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
16	4.7556	86½	44	20	4.7556	87½	44½
17	4.7556	86½	44	21	4.7556	88¼	44½
18	4.7556	86¼	44	22	4.7550	88¼	44½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Aug.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
	24½		10.40	10¼	8.35
16	@25	63	@10.80	@10½	@8.40
	24½		10.30	10¼	8½
17	@25	62½	@10.70	@10.70	@8⅝
	24½		10.30	10¼	8.15
18	@25½	62½	@10.70	@10⅜	@8.35
	24½		10.30	10¼	8
20	@25½	62¾	@10.70	@10⅜	@8⅛
	24½		10.30	10¼	8
21	@25½	62¼	@10.70	@10⅜	@8⅛
	24½		10.30	10¼	7⅞
22	@25½	62	@10.70	@10⅜	@8

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Aug.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
16	120	119½	137	244¾	241¼	30½	54
17	120	119½	137	244	241	30½	54
18							
20	120	119½	137	243	240	30½	54
21	120	119½	137	242½	239¾	30½	54
22	120	119½	137	242	239	30½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

NEW YORK—Aug. 22

The markets were again very dull and unsettled, owing to the continued uncertainty respecting the attitude of Washington. The fixing of a price for bituminous coal, announced on Aug. 22, which price was lower than the producers expected, did not add anything on the side of optimism.

Copper, Tin, Lead and Zinc

Copper—A little business was done from day to day, chiefly for September-December and October-December delivery, and chiefly with speculators. This business was done mainly at prices from 24½@25c., cash, New York. Small lots of spot copper were reported sold at 27@27½c., but the amount of such business was insignificant.

The copper market is tied up by the uncertainty centering in Washington. Manufacturers hold off, and will continue to do so, as long as they think that the Government is going to fix arbitrarily a price for copper much lower than the prevailing price and is going to compel producers to supply everybody at that price. A large part of our copper supply comes from foreign producers and how the Government is going to compel them to sell at an arbitrary price, unless they want to, has not been explained. In the meanwhile, there is considerable confidence in the report that the price of 22½c. has been agreed between the Government and the producers, with 2½c. additional left pending for further adjustment. Respecting this matter, nothing new developed during the week. The delay in these negotiations is not interfering with the Government getting its supply of raw material, for the Government requisitions what it wants and producers supply it. The Government, in requisitioning, pays no attention to the position of producers, which creates embarrassments that frequently are relieved only by consumers relinquishing their contractual claims.

The statistical position of copper is becoming very strong, for domestic consumers are undoubtedly using up the supplies in their yards, while on the other hand production is diminishing. The Great Falls refinery is idle. Raritan, which was the next to exhaust its stock of crude, is now running only at two-thirds capacity and shortly will have to reduce to a 50% basis. Another large refinery is down to three-fourths normal production and expects a further reduction in September. The other works are still supplied with crude, but their stocks are getting low.

Copper Sheets are quoted at 37c. per lb. for hot rolled, and 1c. higher for cold rolled. Wire is quoted nominally at 33c. per lb., f.o.b. mill.

Tin—This market was very dull, especially in Straits. There were a few transactions in Banka and Chinese tins, but the total turnover of the week was probably not more than 125 tons. Banka tin fell as low as 58½c., but recovered to 59c. at the close.

Lead—Some business pending at the close of last week and the early part of this week developed that there was considerable lead in the hands of consumers, which they were willing to sell. On the other hand, the demand from domestic consumers was light. Canada, which was expected to be a buyer in this market, has not come forward. The strike situation in Missouri is improving, and the principal producer is back to nearly normal production, although things are not yet going smoothly. These several factors combined to produce an easier tone in the lead market, and at the close, while nearly 10½c. might have to be paid for August lead, September could be had at 10⅜c. and October-December was offered at 10c.

Zinc—This metal was dull and toward the close became distinctly weak under pressure from producers who were not disposed to accumulate any more stock. Sales were reported at 8c., there were sellers over that price, and there was strong reason to believe that any consumer who wanted a round lot of the metal could do better.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—This market which has been featureless for months livened up and several sales were made at 50c. per lb. for No. 1 ingot, New York.

Antimony—Very dull. Quoted unchanged at 15@15½c. for spot. Futures quoted at 14¼@14½c., c.i.f. in bond.

Bismuth—Unchanged at $3.50 per pound.

Cadmium—Unchanged at $1.40@1.60 per pound.

Nickel—Steady at 50c. per lb., premium of 5c. per lb. for electrolytic.

Quicksilver—Unchanged at $115, with moderate activity. Stocks in this market reported light. San Francisco reports, by telegraph, $110, market steady.

Gold, Silver and Platinum

Gold—Some further shipments of gold to Japan were made this week, reaching a total of $3,000,000, and about $1,000,000 in all was sent to South America. Shipments to Japan this year have been in settlement for exports. A moderate amount of gold has been sent to British India in the same way.

Silver—London market continues firm on very moderate supplies. Considerable silver has been sold ahead for the balance of the year, and this will limit cash offerings when time of delivery arrives.

Mexican dollars at New York: Aug. 15, 67⅝c.; 16, 67⅝c.; 17, 67⅝c.; 18, 67⅞c.; 20, 68¼c.; 21, 68¼c.

Coined silver in the United States Aug. 1 is estimated by the Treasury Department as follows: Standard dollars, $568,270,061; subsidiary coins, $199,470,157; total face value, $767,740,218. Of the standard dollars $473,488,048 are held in the Treasury against silver certificates outstanding.

Platinum—Sales reported at $103@105, with the market fairly active.

Palladium—Strong at $120.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 18—Blende, per ton, high, $78.80; basis 60% Zn, premium, $75, medium to low, $70@65; calamine per ton, basis 40% Zn, $40@38; average selling price, all grades of zinc, $67.55 per ton.

Lead, high, $123.70; basis 80% Pb, $120 @100; average selling price all grades of lead, $111.10 per ton.

Shipments—Blende, 9748 tons; calamine, 681 tons; total value, $704,580.

A stronger market for zinc ore is shown in the increased average price, brought about by an advancing price on some of the intermediate grades with no quotable change in the base range. Sending away the soldiers and preparing to send away the first call of the draft is reducing the working force to an extent that is perceptible in a lowering production. On the other hand the car situation is most vexatious, with each buyer putting in more time securing cars than he does in buying ore.

Platteville, Wis., Aug. 18—Blende, basis 60% Zn, $70 for premium ore down to $65 for medium grade. Lead ore, basis 80% Pb, $110 per ton. Shipments reported for the week are 2559 tons of zinc ore, 144 tons of lead ore, and 449 tons of sulphur ore. For the year to date the figures are: 89,036 tons of zinc ore, 4264 tons of lead ore, and 18,272 tons of sulphur ore. Shipped during the week to separating plants, 3611 tons of zinc ore.

Other Ores

Manganese Ore.—Unchanged at $1 for high-grade metallurgical ore.

Molybdenum Ore.—For molybdenite assaying 90% molybdenum sulphide, $2.20 was asked, $2.10 was reported bid. No business was reported done, but $2.15 doubtless would have been accepted.

Tungsten Ore—Scheelite sold at $28 per unit. High-grade wolframite realized $25, while for ordinary grades $20 was quoted. The turnover amounted to several hundred tons.

Pyrites—Spanish lump quoted at 15½c. per unit on basis of 10s. ocean freight, buyer to pay war risk, excess freight and any duty. Ocean freights are slightly easier, several charters having been made at 32s. 6d. for northern ports, about 3s. less than heretofore.

Iron Ore—Prices, delivered lower Lake ports are for old-range bessemer, $5.95; old-range nonbessemer, $5.20; Mesabi bessemer, $5.70; and Mesabi nonbessemer, $5.05.

In connection with the recent allotment of 150,000 tons of rails to various rail mills by the Government, at the standard price of $40, the Bethlehem Steel Co. shows a cost of production of about $55. This is due to the difficulty in importing ore, and the high ocean freights. Last year's ore production was 75,167,672 tons, shipments from mines being 77,870,553 tons. Imports were 1,325,621 tons. The supplies were about 80% from Lake Superior, 18% from other districts and less than 2% through imports.

Iron Trade Review

NEW YORK—Aug. 22

While the steel trade waits for the Government to decide what it will pay for munition and ship steel, and expects that decision soon, the situation as to prices of steel for the Allies and the public is in no respect clearer, says "Iron Age." The President's announcement of a $2 base on bituminous coal instead of the concession of a $3 price made by the operators is no surprise, and it does not furnish the key to the vastly more complicated problem of steel prices. Coke prices, it is to be expected, will be fixed in line with coal, but as the fixing of a low price for coke will not increase the supply and may lessen it, the effect on the pig-iron market is yet to be determined.

Cheaper coal, however, will mean lower cost in melting and heating operations at steel works and hence some revision of cost sheets now in the hands of the Government.

PITTSBURGH—Aug. 21

The turnover in steel products is still lighter, the stagnation existing for several weeks being intensified. Purchases are entirely of material for earlier delivery and aggregate an extremely small tonnage. Specifications on contracts are lighter and on the whole are averaging less than the shipments. Buyers are awaiting lower prices and seem to be fortified for a long wait. While there has been little prospect at any time that the Government would undertake to fix steel prices for the general trade, the report of the Federal Trade Commission on costs is to the effect that costs vary greatly, giving the Government no definite basis on which to proceed. With this situation developed, the steel makers will probably be in more accommodating mood with the Government as to its purchases and the purchases of the European Allies. Most of the steel required for 6000 freight cars to operate on the American road in France is placed.

The general price readjustment in the iron and steel market is proceeding slowly, but not more slowly than is common in the early stages of such a movement. It is expected that the Government will shortly fix prices on coke, under authority granted by the Lever Food-Control law, and this will doubtless soften pig iron, reacting eventually on unfinished and finished steel.

Production of steel is increasing, with more favorable weather. Production of steel ingots since the first of this year has averaged a rate of about 43,000,000 tons a year, but has lately been a trifle heavier. Capacity is about 49,000,000 tons.

Pig Iron—Market continues stagnant and there is little being done even in resale iron. Furnace quotations are unchanged, but are largely nominal: Bessemer, $55; basic, $52; foundry and malleable, $53@55, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—There continue to be offerings of billets at $85, occasionally at a shade less. A little business in sheet bars is reported at $85 but the usual asking price is $90. Rods are easier, there being little difficulty in buying at $90. On an average the unfinished-steel market is down about $10 from the top level.

Ferroalloys

Ferromanganese—Market continues quiet and rather easy, with prompt and second half at $375@400 and first half at $350@375 per ton delivered.

Coke

Connellsville—The market experienced a further advance Friday and Saturday of last week, but this week has been easing off and is a shade lower than a week ago, at $13@14.50 for spot furnace and $14@15 for spot foundry. Car supply is somewhat improved. Cost sheets for the Federal Trade Commission are being completed and show an average slightly under $4 a ton. The Government is expected to fix a price within a few weeks, probably not far from $5.

STOCK QUOTATIONS

N. Y. EXCH.†	Aug. 20
Alaska Gold M.	5⅛
Alaska Juneau	4⅛
Am.Sm.& Ref.,com.	102½
Am. Sm. & Ref., pf.	113⅛
Am. Sm. Sec., pf., A	99½
Am. Sm. Sec., pf. B	93
Am. Zinc	23½
Am. Zinc, pf.	60
Anaconda	76⅛
Batopilas Min	1⅛
Bethlehem Steel	114
Bethlehem Steel, pf.	115½
Butte & Superior	36⅛
Cerro de Pasco	33⅛
Chile Cop.	19
Chino	55⅛
Colo.Fuel & Iron	48
Crucible Steel	80⅛
Dome Mines	10
Federal M. & S.	23
Federal M. & S., pf.	50
Great Nor., ore ctf.	35
Greene Cananea	42½
Gulf States Steel	109½
Homestake	108
Inspiration Con.	55⅛
International Nickel	37⅞
Kennecott	42⅛
Lackawanna Steel	88⅛
Miami Copper	37⅛
Nat'l Lead, com.	54
National Lead, pf.	‡105
Nev. Consol.	22⅛
Ontario Min.	6⅛
Quicksilver	1⅛
Quicksilver, pf.	1⅛
Ray Con	27⅛
Republic I. & S., com.	89½
Republic I. & S., pf.	‡104
Sloss-Sheffield	53⅛
Tennessee C. & C.	17⅛
U. S. Steel, com.	123⅞
U. S. Steel, pf.	117⅞
Utah Copper	104
Va. Iron C. & C.	‡69

N. Y. CURB†	Aug. 20
Big Ledge	1⅛
Butte & N. Y.	1⅛
Butte C. & Z.	9⅛
Caledonia	.71
Calumet & Jerome	1.68½
Can. Cop. Corpn.	2.56½
Carlisle	4⅛
Cashboy	.09½
Con. Ariz. Sm.	2.56⅛
Con. Coppermines	11⅛
Con. Nev.-Utah	.06½
Emma Con.	‡1 1/16
Ferber	‡.60
First Nat. Cop.	3
Goldfield Con.	.55
Goldfield Merger	.05
Greenmonster	.75
Hecla Min.	9 3/16
Howe Sound	5⅛
Jerome Verde	1⅛
Kerr Lake	5⅛
Magma	51
Majestic	‡.40
McKinley-Dar-Sa.	.58
Milford	2
Mohican	.75
Mother Lode	.37
N. Y. & Hond.	16
Nipissing Mines	8⅛
Ohio Cop.	1.31⅛
Ray Hercules	3⅛
Richmond	.55
Rochester Mines	.55
St. Joseph Lead	20⅛
Standard S. L.	.65⅛
Stewart	
Success	.28
Tonopah	6⅛
Tonopah Ex.	2.43⅛
Tribullion	.31⅛
Troy Arizona	.19
United Cop.	⅛
United Verde Ext.	36⅛
United Zinc	4⅛
Utica Mines	.23
White Knob, pf.	‡1⅛
Yukon Gold	2⅛

SAN FRAN.*	Aug. 21
Alta	.03
Andes	.10
Best & Belcher	.02
Bullion	.01
Caledonia	.10
Challenge Con.	.01
Confidence	.05
Con. Virginia	.18
Gould & Curry	‡.02
Hale & Norcross	.03
Jacket-Cr. Pt.	.11
Mexican	.12
Occidental	.60
Ophir	.09
Overman	.01
Savage	.02
Seg Belcher	‡.01
Sierra Nevada	.09
Union Con.	.29
Utah Con.	.01
Belmont	4.75
Jim Butler	.97
MacNamara	.14
Midway	.12
Mont.-Tonopah	.20
North Star	.10
Rescue Eula	.21
West End Con.	.75
Atlanta	.10
Booth	.07
Comb. Frac.	.04
D'field Daisy	.03
Florence	.04
Jumbo Extension	.25
Kewaunas	.12
Nevada Hills	.15
Nevada Packard	.31
Round Mountain	.27
Silver Pick	.10
White Caps	1.37½
Big Jim	‡.69
United Eastern	4.17½

BOSTON EXCH.*	Aug. 21
Adventure	2½
Ahmeek	100
Algomah	.50
Alloues	.65
Ariz. Com., ctfs.	11⅛
Arnold	.25
Bonanza	.21
Butte-Balaklava	.55
Calumet & Ariz.	78⅛
Calumet & Hecla	550
Centennial	17⅞
Copper Range	61⅛
Daly West	1⅛
Davis-Daly	5⅛
East Butte	11
Franklin	6
Granby	79
Hancock	13⅛
Hedley	15
Helvetia	.25
Indiana	2
Isle Royale	30
Keweenaw	2
Lake	9⅛
La Salle	3⅛
Mason Valley	7⅛
Mass	11
Mayflower	2
Michigan	1⅛
Mohawk	81
New Arcadian	3
New Idria	14
North Butte	17⅛
North Lake	1
Ojibway	1⅛
Old Dominion	55⅛
Osceola	85⅛
Quincy	86
St. Mary's M. L.	76
Santa Fe	1 1/16
Seneca	7⅞
Shannon	7⅛
Shattuck-Ariz.	24
So. Lake	3
So. Utah	.16
Superior	7⅛
Superior & Bost.	4
Trinity	6⅛
Tuolumne	4⅛
U. S. Smelting	61⅛
U. S. Smelt'g, pf.	50
Utah Apex	2⅛
Utah Con.	16
Utah Metal	4⅛
Victoria	3⅛
Winona	3
Wolverine	46⅛
Wyandot	.25

BOSTON CURB*	Aug. 20
Alaska Mines Corp.	.50
Bingham Mines	12⅛
Boston Ely	.75
Boston & Mont.	.73
Butte & Lon'n Dev.	.16
Calaveras	3⅛
Calumet-Corbin	.01
Chief Con.	2⅛
Cortez	.15
Crown Reserve	.25
Crystal Cop.	.80
Eagle & Blue Bell	2⅛
Houghton Copper	‡.90
Intermountain	1 1/16
Iron Cap, Com.	16⅛
Iron Cap Cop., pf.	16
Mexican Metals	.30
Mines of America	1⅛
Mojave Tungsten	.47
Nat. Zinc & Lead	.37
Nevada-Douglas	1 1/16
New Baltic	1⅛
New Cornelia	17⅛
Oneco	‡.45
Pacific Mines	‡.30
Rex Cons.	.18

SALT LAKE*	Aug. 20
Bannack	.55
Big Four	.03
Black Jack	‡.06
Cardiff	4.00
Colorado Mining	17
Daly-Judge	8.60
Empire Copper	1.30
Gold Chain	.18
Grand Central	.50
Grand Gulch	‡.19
Iron Blossom	.89
Lower Mammoth	.03
May Day	.07
Moscow	.15
Prince Con.	.98
Silver-King Coal'n	2.95
Silver King Con.	4.15
Sioux Con.	.11
So. Hecla	1.35
Uncle Sam	.04
Wilbert	.25
Yankee	.07⅛

TORONTO*	Aug. 20
Bailey	‡.03
Beaver Con.	.36
Buffalo Mines	1.00
Chambers Ferland	.13⅛
Conlagas	4.00
Hargraves	.11
La Rose	.50
Peterson Lake	.11
Right of Way	.05
Temiskaming	.32½
Wettlaufer-Lor.	.05
Dome Exten.	.16
Dome Lake	.17
Foley O'Brien	.60
Hollinger	4.40
McIntyre	1.52
Newray	.68
Porcu. Crown	.38
Schumacher	.42
Teck-Hughes	.48
Vipond	.32
West Dome	.17⅛

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Aug. 21
Cresson Con.	5.75
Doctor Jack Pot.	.04
Elkton Con.	.04½
El Paso	.26
Gold Sovereign	.04⅛
Golden Cycle	2.08
Granite	.45
Isabella	.10
Mary McKinney	.11
Portland	1.40
United Gold M.	.18⅛
Vindicator	.55

LONDON	Aug. 6		
	£	s	d
Alaska Mexican	0	10	0
Alaska Tre'dwell	1	2	6
Burma Dorp.	3	18	9
Cam & Motor	0	10	0
Camp Bird	0	6	6
El Oro	0	9	0
Esperanza	0	9	0
Mexican Mines	4	15	0
Nechi, pfd.	0	12	6
Oroville	0	15	9
Santa Gert'dis.	0	10	0
Tomboy	0	18	6

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	74.745	23.570	35.477	37.940
June	49.034	65.024	76.971	23.267	31.060	39.065
July	47.519	62.940	79.010	22.597	30.000	40.110
August	47.163	66.083		22.780	31.498	
September	48.680	68.515		23.591	32.584	
October	49.385	67.855		23.925	32.361	
November	51.714	71.604		25.094	34.192	
December	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	28.788	135.457	130.000	152.522	142.000
June	26.601	29.962	112.432	130.000	137.455	142.000
July	23.865	26.620	95.119	128.409	125.500	140.409
Aug.	26.120		110.283		126.304	
Sept	26.855		113.905		134.071	
Oct	27.193		122.750		142.523	
Nov	30.625		134.659		155.432	
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
April	51.230	55.910	199.736	220.171
May	49.125	63.173	196.311	245.114
June	42.231	62.053	179.466	242.083
July	38.510	62.570	168.357	242.181
August	38.565		169.870	
September	38.830		171.345	
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av year	43.480		182.096	

Lead	New York		St Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	10.207	7.332	10.202	32.967	30.500
June	6.936	11.171	6.749	11 123	31.011	30.500
July	6.352	10.710	6.185	10.644	28.137	30.500
August	6.244		6.088		29.734	
September	6.810		6.699		30.786	
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.853		6.777		31.359	

Spelter	New York		St Louis		London	
	1916	1917	1916	1917	1916	1917
Jan	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	9.362	14.106	9.192	94.217	54.000
June	11.752	9.371	11.582	9.201	68.591	54.000
July	8.925	8.643	8.755	8.473	50.750	54.000
Aug.	8.730		8.560		51.587	
Sept	8.990		8.820		52.095	
Oct	9.829		9.659		54.159	
Nov.	11.592		11.422		56.023	
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30 95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.90	38.90	19.45	40.06
May	21.78	46.94	19.11	42.84	19.58	43.60
June	21.95	54.22	18.95	50.05	19.34	50.14
July	21.95	57.45	18.95	53.80	19.20	53.95
August	21.95		18.95		19.22	
September	22.88		19.58		19.53	
October	24.61		21.26		21.51	
November	30.07		28.18		26.55	
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.